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ABSTRACT

Contained in this volume are abstracts of papers presented at the 144th national meeting of the American Association for the Advancement of Science. Included are abstracts of symposium presentations, contributed papers, and poster sessions. Topics include the natural, physical, and social sciences. (BB)

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Abstracts of Papers

of the 144th National Meeting
12-17 February 1978

Washington, DC

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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CONTRIBUTED PAPER SESSIONS

The contributed papers are grouped by subject into sessions as shown below. Poster sessions are specially marked. The bracketed letters after each session title correspond with the coded session room locations.*

Monday, 13 February

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Zoology (Reproductive) [SA:CN]	263–269
Pharmaceutical Sciences [SA:CC]	315–325
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3:00 pm	
Energy (Policy) [SA:CM]	111–120a
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Tuesday, 14 February

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Economics, Education, and Policy (*Poster*) [SP:Exhibit Hall]	714–738

3:00 pm	
Energy (Geothermal) [SA:CM]	132–141
Ecology (Marine) [SA:CO]	212–221
Zoology (Marine) [SA:CN]	288–298
Medical Sciences (Cancer and Diseases) [SA:CC]	355–364
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*See inside back cover.

Abstracts of Papers

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Symposium Abstracts

1. GENERAL INTEREST

The Frontiers of the Natural Sciences

Arranged by ROLF M. SINCLAIR (NSF)

Mon., 13 Feb. / Sheraton-Park / Continental

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Chemical Ecology: a Frontier of the Natural Sciences. THOMAS EISNER (Cornell University).

All organisms are chemosensitive, and all are the source of substance to which others can potentially respond. In the course of evolution this potential for interaction has been thoroughly "exploited", and organisms of the most diverse kinds have come to establish chemical relationships, both mutualistic and antagonistic, with other organisms in their environment. These relationships are of the most interesting and subtle kinds, and an appreciation of their pervasiveness and diversity is central to our understanding of the fabric of nature itself. Biologists and chemists have come to collaborate in this field, which under the term of chemical ecology has achieved current prominence in the frontiers of the natural sciences. The lecture will deal with recent studies of the chemical ecology of insects, and will focus on certain aspects of predator-prey and herbivore-plant interaction.

Animal, Vegetable, and Mineral Geothermometers. ANITA G. HARRIS (U.S. Geological Survey, Washington, D.C.)

Heat affects the generation, quality, and preservation of organic fuels. Thus, the temperature to which rocks have been heated is crucial for evaluating the oil and gas potential and coal quality of any terrane. There has been much economic impetus to develop quantitative and qualitative geothermometers. As a consequence, geologists utilizing the mineral and (or) organic constituents of rock, now have a variety of techniques for assessing thermal grade (metamorphism). Analyses of organic materials such as spores, pollen, vitrinite, coal, and kerogen use chemical and optical techniques; optical techniques are more commonly used for minerals. Organic materials provide indices of thermal grade between 30° and 300°C; mineral indices cover a larger thermal range (50°-800°C) but are coarser geothermometers. A new index of animal origin, conodonts, combines organic and mineral indexing in one element.
Conodonts are 180-million- to 550-million-year-old apatitic marine microfossils. During low-grade thermal metamorphism (50°-300°C), they change color from pale yellow to brown to black because of carbon-fixing within the trace amount of organic matter in their skeletons. As thermal metamorphism continues (300°-600°C), conodonts change from black to gray to white to crystal clear as a result of carbon loss, release of water of crystallization, and recrystallization. The conodont-color-alteration technique provides a unique link between mineral and organic indexing and is applicable in terranes where bedrock age and composition commonly exclude the use of other thermal indices.

The Frontiers of Physics D. ALLAN BROMLEY (Yale University).

A brief review of the most recent progress in the subfields of physics -- ranging from relativistic astrophysics through particle, nuclear and atomic physics to condensed matter science, optics and acoustics will be presented with examples drawn from contemporary research.

The Frontiers of Natural Sciences - Chemistry. NORMAN HACKERMAN (Rice University).

The important advances that bring us up against the current boundaries of understanding in chemistry depend in large part on major advances in instrumentation. The ability to explore more extreme conditions of temperature and pressure plus the ability to follow very fast changes is paramount in our current advances. Further, the orders of magnitude increase in detection and measurement capability - analytical methods - open new vistas not only of effects but also permit looking backwards at very slow reactions. Current instrumentation permits determination of structure even of "structureless" states not to mention those of complex arrangement. It also improves our hold on bonding which makes for better approaches not only to coupling but also to uncoupling of chemical units. Further some chemical experiments can now be done better via computers. The immediate future demands the use of this sophisticated instrumentation to gain experimental insights which push the theorists harder than they have been in some time. It also demands even more progressive application to use such as in food, fiber, material, and medicine for the world's population.

Geometric Measure Theory and the Calculus of Variations. FREDERICK J. ALMGREN, JR. (Princeton University)

With examples such as crystals, soap bubbles, tree leaves, and fishing with a sailboat, we will discuss the mathematical discipline of geometric measure theory and why it is realistically possible to begin to study many problems in geometric optimization and evolution (soap films, for example, seek to minimize energy by minimizing area) which previously had been largely inaccessible to rigorous mathematical analysis.

Astronomy. FRANK D. DRAKE (National Astronomy and and Ionosphere Center, Cornell University).

Astronomy depends on the generosity of the universe for progress. With the exception of solar system studies, the astronomer cannot experiment as other scientists do, but must depend on remote observation. Thus astronomy is subject to frustration growing from the fact that what we would like to observe is very often beyond our powers. We would like to establish even the mere existence of other planetary systems, but they are beyond our instruments. We would like to observe the density of galaxies 10 billion light years away, but this has been beyond our abilities. The good astronomer is constantly choosing between the important and that which can be done. Fortunately, the universe is so rich in fascinating phenomena that many important things which we did not even know to search for have fallen gratuitously into the maws of our instruments. The quasars, the pulsars, the cosmic chemical factory of interstellar molecules -- none of these were predicted, but just appeared one day in our recordings. Serendipity has played as much a role in the progress of astronomy as has careful planning and dogged determination. We are still sufficiently naive that this way of life should continue. As we build more powerful instruments to search for the things we can predict, we will undoubtedly build instruments which are right to find the even more exciting things we cannot predict. We are embarking on an era of development in which our ability to observe both the predictable and unpredictable will be greatly enhanced. The Very Large Array, a radio telescope of resolution much greater than heretofore will soon be operating in New Mexico, allowing us to observe the sky at radio wavelengths with an ability previously held only by optical telescope. The Large Space Telescope will remove the murk of the atmosphere from in front of our eyes, and allow us to see much farther into space, with much greater clarity than heretofore, and will allow us to observe at wavelengths we have so far only sampled. We know how to build enormous optical telescopes on the ground, as well as much larger radio telescopes than now exist, all at reasonable cost. The Space Shuttle will allow us to launch a multitude of astronomical instruments, both for the solar system and deep space, into an environment where many new types of observation are possible. All of this will make some of those important, but impossible things, possible at last. Perhaps we will soon observe the planets of other stars, the earliest years in the life of the universe, the places where cosmic x-rays and gamma rays are made, and those other products of cosmic evolution we are not knowledgeable enough to predict.

*****

Recombinant DNA: Current Status of Regulatory Legislation

Arranged by CLIFFORD GROBSTEIN (Univ. of California, San Diego)

Mon., 13 Feb. / Sheraton-Park / South Cotillion

3:00 p.m.- 6:00 p.m.

*****

Blacks in Science, Medicine, and Invention

Arranged by RONALD E. MICKENS (Fisk Univ., Nashville, Tn)

Tues., 14 Feb. / Shoreham / Tudor

9:00 a.m.- 12:00 m.

First Physicists. JOSEPH A. JOHNSON III (Rutgers University, New Brunswick, N. J.)

Major scientific achievements of some of the very earliest physicists will be reviewed along with the apparent applications of their accomplishments in the recent evolution of western science. Attention will be given to the influence which varying cultural perspectives has had on the development of physical and physicist models. In this context, a profile of the first Black american physicist will be presented; a few speculations on future trends and options for the Black scientific community will also be offered.

From Carver to Hill, and on. SAMUEL P. MASSIE (United States Naval Academy.)

The story of blacks in Chemistry is an ever-continuing saga of determination, expectation, participation, and contribution. Although there were early pioneer teachers like Talley of Fisk, this story may well be said to begin with the legendary agricultural chemist, Carver, and to continue with personalities like Brady, the first doctorate, Lloyd Hall, the industrial pioneer, the first MCA awardee, Moddie Taylor, the industrial vice-president, Lloyd Cooke, the textbook writer, Lloyd Ferguson, and the late Dolphus Milligan. Percy Julian commands his own chapter. Perhaps the greatest recognition of all was the election of the 1977 President of the American Chemistry Society, Henry A. Hill.
This paper shall present some of the achievements and contributions of these and others, as we travel the road from Carver to Hill, and on. It shall give an overview of the present and some hopes for the future.

Black Americans in Mathematics. JAMES A. DONALDSON (Howard University).

Mathematics, a discipline central to Science and Society, has been enriched by contributions from nearly every group. In this paper an abridged historical perspective of the role of Black Americans in Mathematics is presented. Some contributions to Mathematics are given; several problems confronting them are stated; and solutions of these problems are proposed.

Blacks in Biology and Medicine: An Accounting of the Commendable But Little Known Past, Improved Present and Future Promise. JOHN S. BROWNE (Atlanta University and Rockfeller University).

In the annals of documented accomplishments of scientists and practioners in Biology and Medicine very limited or no mention at all has been made of the contributions of black people. Individuals such as Carver, Drew, Coombs, Just, White and many other unsung black people have made pioneering but significant contributions to the contemporary advances now firmly incorporated into biological and medical literature. These accomplishments should not be overlooked and must be overtly espoused if the past and present contributions of black scientists and physicians are to serve as role models for stimulating increased participation of talented young blacks in the fields of biology and medicine.

Black Americans In The Field Of Invention. ROBERT C. HAYDEN (Education Development Center)

This paper will(1) give a historical review and analysis of the role of Black Americans in the field of patented inventions, and (2)show by example that Black Americans have made inventions that have revolutionized various aspects of life and work in America.
Before the Civil War the inventions of Black Americans could not be recognized since patents(contracts between the inventor and the U.S. government)were not issued to those persons not considered to be U.S. citizens. There were several exceptions to this ban however. Most slaves turned over to or had stolen by their owners mechanical inventions they designed to ease the burden of daily toil. After the Civil War Black Americans were able to gain U.S.patents.
In 1900 the U.S. Patent Office attempted to obtain information concerning patents issued to Black inventors after the Civil War. Between 1865 and 1900, more than 1,000 patents were identified as being owned by Black Americans.
The history of Black Americans in invention before and after the Civil War will be given and specific examples will be described. Lewis Temple(the toggle harpoon);Lewis Latimer (light bulb filament);Frederick Jones(refrigeration units); Norbert Rillieux(sugar refining process);Elijah McCoy(automatic lubricating devices); Dr. George Grant(golf tee). The accomplishments of these and other inventors as well as the problems and issues they faced being both inventors and Black in America will be discussed.

*****

Sociobiology: Beyond Nature-Nurture

Arranged by GEORGE W. BARLOW (Univ. of California, Berkeley) and JAMES SILVERGERG (Univ. of Wisconsin, Milwaukee)

Tues., 14 Feb. / Sheraton-Park / North Cotillion

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Wed., 15 Feb. / Sheraton-Park / North Cotillion

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Sociobiology: Another New Synthesis. DAVID L. HULL (University of Wisconsin-Milwaukee).

In the midst of the turmoil over sociobiology, we tend to forget that it is a new scientific movement like many before and that it is likely to succeed or fail for the usual reasons. Wilson terms sociobiology a new synthesis. It is neither new nor thus far a synthesis. The sociobiological research program is still largely programmatic. What is new is the conviction that headway can be made in explaining a wide variety of social traits on the basis of evolutionary theory. Future generations of sociologists/biologists may look back and conclude that sociobiology succeeded. They will draw this conclusion even though they agree with very few of the claims currently being made by sociobiologists, even though only minimal advances are made in explaining social behavior biologically. Sociobiology will have succeeded if the advances which do take place are made by the scientists who term themselves sociobiologists and if future generations of sociologists/biologists consider their ideas to have been descended from those now being developed by sociobiologists.

Ecological Determinism and the Adaptiveness of Sociality. STEPHEN T. EMLEN (Cornell University).

The major advantages and disadvantages of gregarious living will be discussed. The principal advantages relate to 1) increasing detection, avoidance, and protection from predators, 2) increasing efficiency in locating and exploiting unpredictable, patchy resources (esp. food), and 3) providing a social milieau in which learning and cultural transmission of information can take place.

Many aspects of animal social organizations can be viewed as adaptive solutions to ecological problems. It is argued that there exist a limited number of solutions to common, recurring ecological problems. This leads to a predictable convergence of social organizations in response to constraining ecological factors. I call this phenomenon ecological determinism.

The sociobiology issue has often focused upon conflicting views of the importance of genetic determinism for understanding social behavior. What has been overlooked is that ecological determinism, which often assumes a high degree of behavioral plasticity, leads to a parallel set of predictions concerning the form of animal spacing and mating systems. The importance of this conclusion to the sociobiology "debate" will be examined.

Genetics of Animal and Human Behavior. J. C. DeFRIES (University of Colorado).

Genetic analyses of animal and human behavior are exemplified by three separate studies. As part of a large-scale investigation of open-field behavior in laboratory mice, bidirectional selection for open-field activity (a character with only moderate heritability in the foundation population) was undertaken. High and low lines resulting from 30 generations of selective breeding have nonoverlapping distributions and more than a 30-fold difference in mean activity. Results of this study illustrate the polygenic nature of individual differences in many animal behaviors. Of greater relevance to sociobiology is a study of the relationship between social dominance and reproductive success in laboratory mice. In each of three experiments in which males and females were placed in standardized social living units, dominant males sired over 90% of resulting litters. If social dominance has been a major component of fitness during the evolution of house mice, most of the observed genetic variance should be nonadditive; thus, considerable heterosis should occur for this character and little additive genetic variance should exist. Results of recent experiments are consistent with these expectations. In order to illustrate genetic analyses of complex human behavioral characters, results of the Hawaii Family Study of Cognition shall be presented. The resolving power of the family study method shall then be contrasted to that of adoption studies.

Biological and Cultural Determinants of Human Behavior. FRANK B. LIVINGSTONE(Dept. of Anthropology, Univ. of Michigan).

Behavior genetics, ethology, and more recently sociobiology have all rekindled interest in the biological determinants of human behavior, but there is still considerable disagreement as to their relative importance. The variation in behavior among human populations, the primary concern of anthropology, raises particular problems. Behavior geneticists have estimated the heritability of many behavioral traits within human populations, and a positive heritability undoubtedly exists for some. But behavioral and physical traits with high heritabilities have changed so dramatically in the last 50 years, the interpretation of their variation requires more than genetic theory. Ethology has dealt primarily with human nature or species-specific traits. It assumes that human nature is adapted to the hunting niche man occupied for eons and that no evolution has occurred since then. Given the enormous amount of environmental change in the last few millenia, high evolutionary rates seem more likely. Sociobiology's major assumption is that everyone maximizes their inclusive fitness, but then do the different behaviors, assuming they do this, imply different genotypes? Most sociobiological speculation seems unclear on this point. If there are no genetic differences, then how is this variation explained by evolutionary theory?

Male Bias in the Study of Sex Differences. STEPHANIE A. SHIELDS (University of California - Davis).

The scientific study of sex differences has historically been characterized by a confusion between scientific objectivity and social subjectivity. Attempts at objectivity have been confounded by the domination of the sciences by males and consequent male-oriented values. Far from a conscious conspiracy to demean females, the interplay of attempted objectivity and real social subjectivity have consistently blurred attempts at appraisal of sex differences. Sociobiology shares with its theoretical forebears (particularly Social Darwinism a peculiar susceptibility to bias in this area. This paper describes the history of such unintentional bias and its social consequences. The implications of this history for sociobiological study of sex differences are then discussed. The emphasis here is not on whether sociobiology is inherently sexist, but on the persistent problem posed by social issues in any theoretical formulation of sex differences.

Genes, Hormones, and Gender. ELIZABETH K. ADKINS (Cornell University).

In non-human animals, sex hormones secreted by the fetal gonads evidently channel brain development into a male or female direction with respect to mating behavior. The sex of the fetal gonads is determined by a single chromosome, and possibly by a single gene on this chromosome. The developmental origins of sex differences in humans involve a complex interaction between sex chromosomes, sex hormones secreted by the fetal gonads, and the social environment. This interaction results in occasional variations in the development of physical sex, and in considerable variation and marked individual differences in the development of gender identity and sex role. There is not yet any firm evidence that fetal hormones actually program human brain development, nor that they determine adult gender identity or sex role to a significant extent. This plasticity in human gender development is highly adaptive. In non-humans, sex hormones activate mating behavior in adults as well as channel its development early in life. The evidence that sex hormones underly gender-related behavior in adult humans will be critically discussed, including the literature on changes in behavior correlated with the menstrual cycle.

Sexual Reproduction and Partial Conflict in a Mendelian Population. GEORGE C. WILLIAMS (State University of New York, Stony Brook).

Outbreeding is widely recognized as imposing a cost to fitness. Recent workers have envisioned that this cost is borne by the population or by certain individuals or groups within it, and that it varies in complex ways with reproductive physiology and behavior and other features of the life history. The author defends the position that the cost is a precisely 50% tax on all investment in reproduction with haploid gametes, and is independent of paternal contributions, sex ratio, anisogamy, and other considerations previously invoked. All sexually reproducing populations are rapidly invadable by parthenogenetics. These conclusions are shown to follow from widely accepted formulations of kin selection. The cost of meiosis is basic to an understanding of partial conflict based on fractional coefficients of relationship, and of the ecological costs of these conflicts.

Evolutionarily Stable Strategies of Sexual Behavior RICHARD DAWKINS (University of Oxford)

Wilson's excellent New Synthesis is incomplete. It fails to mention a concept which I believe will come to dominate sociobiology, namely that of the evolutionarily stable strategy (ESS), developed by Maynard Smith and Price. An ESS is a strategy which, when a majority of the population adopts it, cannot be bettered by a mutant strategy. The word 'strategy' is already much used in the literature on functional interpretation of behavior, but it is often accompanied by a simple label of quality: a 'bad' strategy, a 'good' strategy; even, sometimes, an 'optimal' strategy. The concept of evolutionary stability is more subtle than this. The point is that what is favored by selection will depend on what other members of the population are doing. If most individuals do A then B may be 'better', say; but if most individuals do B, A is favored. In such cases, neither strategy is absolutely better than the other. What will evolve is an evolutionarily stable strategy, perhaps some mixture of A and B. Such mixtures can either be polymorphisms, or each individual can behave in a mixed way. Maynard Smith and Price applied their idea to aggression. I shall discuss its application to sexual conflict.

The Coevolution of Behavioral and Life-history Characteristics.

ROBERT R. WARNER (University of California, Santa Barbara).

Theory in evolutionary ecology predicts how certain environmental conditions would lead to selection for a particular set of life-history characteristics, such as single vs. repeated reproduction, level of reproductive effort, number and size of young, etc. A parallel body of theory is emerging in sociobiology, predicting what sorts of behaviors (especially social and mating systems) are adaptive in particular environments. A combination of these two approaches suggests a series of characters, behavioral and demographic, which should coevolve in certain environments. The environmental factors which appear to be most important at this time are those determining the average level and variability of age-specific mortality (e.g., predation, climate), and the distribution in time and space of food and other resources. In some cases, environmental conditions result directly in independent behavioral and demographic adaptations. At other times, life-history characteristics are adaptations to a preexistent social/mating system, or vice versa. By sorting out the causes and effects, we can gain a more complete picture of non-morphological adaptation. The separate predictions of evolutionary ecology and sociobiology should often be tested together. Because of the change nature of evolution, these tests usually involve predicting the presence of a particular cause on the basis of the known occurrence of a specific effect.

Foraging, Spatial Dispersion, and Mating Systems.

JACK W. BRADBURY & SANDRA L. VEHRENCAMP (University of California, San Diego).

The paper will explore the notion that environmental factors such as food and predation determine animal spatial dispersions, and that mating systems evolve contingent upon those dispersions. Three specific cases will be discussed in which foraging appears to determine female dispersions and thus to limit male reproductive options. In insectivorous emballonurid bats, animals appear to be passively mapped onto the distribution of successively available patches of insects. This affects both the size of groups and the compositional stability of groups. Depending upon group size, compositional stability, and duration of patch use, males of related species show monogamy, resource defense polygyny, or female defense polygyny. In an omnivorous phyllostomatid bat, yearling females which are not relatives form stable age cohort groups. These remain cohesive for the life of the members, show low levels of subsequent recruitment, and may even change colonies as a unit. Although animals forage singly, each female group has an exclusive foraging area suggesting that the advantage of groups is related to food. Male options are limited to short-term defense of female groups. In a frugivorous epomophorine bat, females are solitary and have large overlapping home ranges. This facilitates epigamic mate choice by females and male self-advertisement. Male dispersion is a function primarily of the size of female home ranges, and in related species with large female home ranges, males form leks for mating.

The Natural History of Kin Selection.

MARY JANE WEST-EBERHARD (Universidad del Valle, Cali, Colombia, and Smithsonian Tropical Research Institute).

The idea that traits benefitting relatives, even when detrimental to the bearer, might sometimes be maintained by natural selection is a simple extension of classical Darwinian evolutionary theory. Although sometimes viewed as a radical innovation it has been repeatedly mentioned by evolutionary theorists since Darwin, and has long been used to explain parental solicitude. Hamilton's (1964) appreciation and elaboration of this idea has led to its wider use in field and theory, as well as to certain misconceptions, even among professional biologists (e.g., the mistaken belief that "kin" selection differs importantly from individual selection; that it represents "group" or "family" level selection; that it explains all beneficence among kin; and that it applies mainly to insects). The utility and limitations of kin selection theory in explaining animal behavior are illustrated by recent studies of the natural history of social wasps.

The Limits of Nepotism.

PAUL W. SHERMAN (Department of Zoology and Museum of Vertebrate Zoology, University of California, Berkeley, 94720).

To determine the extent to which group-living mammals assist near and distant relatives, the behavior of Belding's ground squirrels was observed from 1974 through 1977 at Tioga Pass, California. Since 1969, 2128 animals have been permanently marked there, including all 603 young from 135 litters. For most, ages and familial relationships are known. While the highly polygynous males do not provide paternal care, females live near and preferentially assist their offspring, sisters, and mothers by (1) cooperatively protecting areas surrounding nest burrows against predatory conspecifics, (2) permitting relatives unmolested access to such defended areas, and (3) giving predator warning calls. By contrast, grandmothers and granddaughters, aunts and nieces, and cousins behave as if they were unrelated. Thus, there appear to be limits of ground squirrel nepotism.

In addition to discussing why Belding's ground squirrels favor only immediate family members, I shall suggest that limits of nepotism will always appear between classes of kin that consistently have a low probability of (1) reducing or avoiding resource competition, (2) living in proximity, or (3) being identified as a relative by a family member common to both and more closely related to each than they are to each other. This hypothesis augments the theory that the extent of nepotism is governed mainly by average relatedness and it implicates resource competition, population demography, and social contingency in the expression of mammalian nepotism.

Kin Selection in Two Human Populations.

WILLIAM IRONS (The Pennsylvania State University), NAPOLEON A. CHAGNON (The Pennsylvania State University).

This paper presents evidence from two human populations, the Yanomamö and Yomut Türkmen, testing the hypothesis that behavior toward kin tends to assume the form which maximizes inclusive fitness. The paper begins with the assumption that in human societies behavior among close kin expresses mixed strategies of reciprocity and nepotism. This takes the form of a long term exchange of benefits among certain kin dyads. The nature of the benefits exchanged and the net benefit derived over a lifetime varies among kin dyads for which the coefficient of relatedness is equal. The emphasis on particular dyads at the expense of others of equal relatedness is explained by differences in the costs and benefits entailed in interaction with kin of different sex and generation. These differences are in turn derived from the particular social environment in which each population is found. In different social environments, the things individuals are able to do to aid kin of different sex and generation and the costs and benefits associated with these acts of assistance vary widely. Data from the Yanomamö and Yomut indicate that kinship behavior fits expectations derived from these considerations.

Kin Selection, Fitness, and Cultural Evolution

B.J. WILLIAMS (University of California, Los Angeles).

A two-part examination of the applicability of aspects of sociobiological theory to human society. The first part examines the assumptions of kin selection. It is concluded that the conditions for the increase of genetic factors in genetically altruistic behavior are more stringent than has been assumed, and less likely to be met in a low fecundity species such as Homo sapiens. The second part presents evidence for changes in biological fitness with cultural adaptations, and discusses the problem of disentangling the fitness effects of cultural evolution and biological evolution.

Parent-Offspring Conflict. J. A. STAMPS & R. A. METCALF (University of California - Davis)

Trivers has advanced a theoretical model of parent/offspring conflict which has been widely debated. Two major objections have been raised to this model: first, that genes contributing to the expression of selfish behavior in offspring could not spread in a population; second, that because of advantages of size and experience parents would always win parent/offspring conflict. Both of these objections have been refuted by theoretical genetic models and computer simulations. Recent theoretical models also indicate fundamental differences in parent/offspring conflict depending on the pattern of offspring production. The Trivers model may apply to species with offspring produced sequentially, but not to those with offspring produced simultaneously. Empirical tests presently lag far behind the theoretical models, in part because of the difficulties in measuring the important variables of parental investment and reproductive success. The most promising candidates for empirical studies are species with food competion among simultaneous offspring, as seen in the social insects and vertebrates such as birds.

Sociobiology and the Theory of Natural Selection: General and Special Difficulties. STEPHEN JAY GOULD (Harvard University).

Natural selection, despite its strengths as a general theory, has traditionally been applied uncritically to individual cases by making up adaptive stories--speculative virtuosity and consistency replace rigor and testability as criteria for good explanations. Most work in sociobiology lies within this old tradition, but encounters special difficulties because homologies (genetic similarities due to common ancestry) are so much harder to recognize for behaviors than for morphology. It meets another and more serious dimension of difficulty in treating human behavior because the argument that equates universal-and-adaptive with genetic fails; for adaptive behavior in humans can be grounded in a parallel and independent system of cultural evolution. The fallback position--genetic basis doesn't matter, establishment of adaptiveness is enough for a biological theory of behavior based on natural selection--largely invalidates the sociobiological research program for humans. We will have no reduction of the human sciences to the Darwinian model, for reduction requires the genetic argument. We will have mutual illumination--a fine thing (humans are animals, after all), but not the stated, hubristic aim of the new synthesis.

Evolution and Behavior: models, theories and paradigms. DAVID P. BARASH (University of Washington and Center for Advanced Study in the Behavioral Sciences)

Evolution by natural selection provides the basic paradigm for sociobiology. This approach to behavior assumes that individuals will behave so as to maximize their inclusive fitness, thereby providing models which can be tested. Several studies of reproductive behavior in birds and fishes show how prediction and hypothesis-testing can be employed in sociobiology, with results supporting the role of evolutionary considerations in influencing behavior. Finally, the theory that such models apply to animal behavior is contrasted with other theories, with possible implications for human behavior as well.

The Limitations of Sociobiological Analysis. ELEANOR LEACOCK (City College, C.U.N.Y.).

Sociobiological theory as a framework for analysis of laws governing the biology and evolution of social behavior is commonly seen as useful for the study of non-human animals, but inadequate for dealing with culture-bearing and language-using humans. The sociobiologist's response is often to concur in part and maintain, reasonably enough, that what relevance the formulation does have for humans should be explored. However, the level of hypothesis being advanced with regard to human social behavior contradicts this disclaimer. It also reveals the limitations of the sociobiological formulation not only for human but also for non-human animal behavior. Contrasting types of social arrangements in human societies, as well as in non-human primate and other animal societies, indicate that qualitative differences in the relations among the individual organism, its conspecific group, and the ecological context, obtain at different levels of animal life. Present formulations of analytic variables fail to deal with these qualitative differences. Attempts at quantification for comparison are often premature and reduce social structure to a mechanical projection of the individual organism's characteristics, thereby nullifying the intent to analyse behavior as the outcome of biological and social relationships.

Trends in Sociobiological Research. EDWARD O. WILSON (Harvard University).

The strength of general sociobiology comes from the applicability of parts of modern theory in population genetics and ecology to the interpretation of social systems, and from the availability of literally tens of thousands of social animal species, scattered over widely disparate phylogenetic groups, for the testing of evolutionary models. In the past ten years progress has been rapid in the analysis of several phenomena: kin selection, caste systems, economic optimization, group size, parental care, breeding systems, and others. The evidence for genetic constraints in human social behavior is substantial, ranging from phylogenetic reconstructions to studies of genetic variation within the species. Sociobiological theory is now being extended to human beings through the creation and testing of a variety of hypotheses based explicitly on the theory.

A Critical Examination of Current Sociobiological Theory: Adequacy and Implications

ARTHUR L. CAPLAN (Hastings Center)

While many areas of disagreement concerning sociobiology hinge upon matters of empirical fact, others concern the nature of central concepts and methods utilized in sociobiological explanations such as adaptation, trait, inclusive fitness, homology, and altruism. An attempt will be made to provide a critique of these and other concepts central to the sociobiological enterprise. On the basis of this critique it will be argued that sociobiological findings are of limited relevance for the analysis and justification of theories in ethics and socio-political theory.

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Science and the Science-Fiction Writer

Arranged by ROLF M. SINCLAIR (NSF)

Wed., 15 Feb. / Shoreham / Empire

9:00 a.m.-12:00 m.

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Participation of Women and Men in Scientific Research

Arranged by MICHELE L. ALDRICH (AAAS)

Wed., 15 Feb. / Sheraton-Park / Arlington-Alexandria
3:00 p.m.-6:00 p.m.

Data on Women in Scientific Research.
Betty M. Vetter (Scientific Manpower Commission).

Women are less than ten percent of the total science and engineering work force, but slightly over ten percent of those principally engaged in research. Women are more likely than men to be engaged in basic research, but less likely at the doctoral level to work in applied research or development and only half as likely to be administrators of research and development.

Proportionally more of women scientists and engineers than of men are employed in academic institutions, and the higher the level of employment of scientists and engineers at universities, the higher the proportion of women. We cannot differentiate faculty women from other employees. However, the proportion of women among scientists and engineers employed at two year institutions (20.4%) is higher than their proportion among scientists and engineers employed at doctorate-granting universities (14.9%).

Doctoral women are less than half as likely as men to be employed in industry.

The data base is inadequate to analyze fully the characteristics of women performing scientific research, either relative to men or relative to women scientists and engineers performing other activities. Changes are needed both in the sampling procedures and in the survey instruments to provide adequate data for analysis of women scientists and engineers apart from men in any activity and in any employment setting. Such changes are recommended.

Experiences of Women and Men in Science. VIRGINIA WALBOT (Washington University).

Within the study sample, the training and early career experiences of women starting to work in science paralleled that for men. Both groups displayed certitude about pursuing such a career, reported a few difficulties in the science curriculum (the requirement of mathematical training, the barrier of course prerequisites, and the long hours in laboratory classes, for example), and manifested an inclination to join scientific organizations relevant for their specialized field. In other regards, differences appeared between these men and women at the threshold of their lives in science. While both groups mentioned teachers and friends frequently as role models, the women (as might be expected) cited female role models more often than men did. In part this reflected the fewer women science teachers encountered by the men in the sample. Some interesting patterns appeared in how men and women financed their education and in the winning of federal grants. An intriguing detail surfaced in examining the scholarly output of the sample: women were more inclined than men to appear as sole author of papers and men more frequently than women, conversely, co-authored with other scientists.

Goals, Aspirations, and Sociological Variables. CORA MARRETT (University of Wisconsin).

Sociologists have reported significant differences between men and women on goals and achievements in professional careers. For example, women are apt to value highly time for their families and the opportunity in their work to contribute to the well-being of society, while men tend to emphasize the need to advance economically via their careers. These studies depend upon the evaluation of a short list of goals (usually ten options) by large numbers of respondents, and the questionnaire must thus be kept short and be susceptible of rapid tabulation. The NSF-AAAS project employed a brief test like this for studying the goals and aspirations of its sample and comparing the men and women's reactions to those reported in previous studies by other scholars. However, since the study sample for this project was small, the NSF-AAAS questionnaires also asked for detailed thoughts the men and women had about goals and aspirations, in the form of paragraph length answers and free-form essays. This paper reports the similarities and differences between the sexes from these longer responses as well as their evaluation of goals on the short list. For example, the married women and men with children spelled out in some detail the difficulties of research scientists who also try to maintain a life with their families.

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Genes and Gender

Arranged by RUTH HUBBARD (Harvard Univ.) and MARIAN LOWE (Boston Univ.)

Thurs., 16 Feb. / Sheraton-Park / North Cotillion
9:00 a.m.-12:00 m.

Sex and Behavior among Primates: Universals and Variations. LILA LEIBOWITZ (Northeastern University).

The genetic basis of behavioral traits is usually argued from the claim that a behavior pattern is universal or nearly universal within a species. This paper will present some of the variations in sex related behaviors found in populations of human and non-human primates. I discuss the significance of such variations in behavior within and between species by showing what these variants suggest about genetically based capacities for flexibility and behavioral adaptability among primates generally, and the higher primates in particular. I examine how researchers have arrived at such notions as the "universality" of male dominance and how the loosely conceptualized notion of dominance is linked to reproductive success. I show that the models of how human societies evolved and operate that we build on such notions not only affect perspectives on social change and social policy but also affect how anthropologists view their data and interpret ethnographic evidence.

The Relationship of Animal Studies to Human Studies. RUTH BLEIER (University of Wisconsin).

There is a tendency of investigators, starting with a deep consciousness of self as universal, to generalize to all species and all epochs their own experiences, values and norms. Thus the behaviors of rodents, primates and australopithecines are viewed in the light of twentieth century American/European male culture and values. This approach is reflected in the language, logic and methodology, as well as the implicit concepts and interpretations applied, usually unconsciously, by scientists. I will draw examples of methodological flaws in experimental designs, observations or conclusions from a number of areas including (1) studies of "aggressivity" in rodents following hormonal manipulations; (2) theories of the critical presence or absence of androgens in the developing brain; (3) studies of dominance, mating and polygamy in primates and the choices that are made for behavioral studies; (4) theories generalizing from stereotypic behavior patterns of various invertebrate and vertebrate species to the intentional and dynamic behaviors of humans. Relevant knowledge of the structure and functioning of the brain will be discussed.

Aggression and Gender: A Critique of the Nature-Nurture Question for Humans. FREDA SALZMAN (University of Massachusetts/Boston).

Recent studies of humans claim that males are innately more aggressive than females due to genetic or hormonal factors. I will review several frequently cited ones and show that they have such serious methodological flaws as to invalidate their conclusions. An example is the claim made by Maccoby and Jacklin in The Psychology of Sex Differences that "the male's greater aggression has a biological component," citing in support the following evidence pertaining to humans:

1) greater aggressiveness in males than females is cross-culturally universal and is found early in life, at a time when there is no evidence that differential socialization has occurred; and 2) aggression is related to levels of sex hormones. I will examine the problem of establishing biological determinants of sex differences in behavior in light of significant evidence which indicates that, in terms of the quantities actually observed in children, differential environmental factors could be considerable from the time social interactions begin after birth, and that environmental factors can cause biological effects. Studies designed to separate genetic, hormonal and environmental factors require rearing children from birth in precisely defined and controlled environments. The theoretical and practical difficulties of such studies appear to be insurmountable at present.

Right and Left: An Examination of Research on Sex Differences in Hemispheric Brain Asymmetry. S. LEIGH STAR (University of California, San Francisco).

I examine the language, assumptions and structure of reasoning in some of the research on sex differences in hemispheric brain asymmetry. The literature presents a classic case of sexist language, sexist interpretation of biological findings, and an attempt at attributing "innateness" to psychophysiological correlates of cognitive tasks. Some of the questions I raise are: whether verbal and spatial tests actually measure verbal or spatial ability; what are the effects of training and socialization on "ability"; how researchers correlate verbal or spatial ability with activation of either side of the brain, and the influence of sex-stereotyping on these attributions. I critique the hypotheses of Buffrey and Grey, and Levy and Sperry about lateralization and sex differences. Finally, I propose alternative interpretations of the data.

Transsexualism: A Problem of Sex Role Stereotyping? An Etiological and Ethical Analysis. JANICE G. RAYMOND (Hampshire College).

I analyze and critique the current body of medical and psychological writing that locates the desire to be transsexed primarily in the intra-psychic, individual, and/or familial spheres. I focus on the omission of any serious consideration of the social context of sex-role stereotyping in which transsexualism arises. On a more philosophical and ethical level, I examine the "medical model" of transsexual etiology and treatment. I seek to prove that medicalization of the issue has taken place in which moral and political questions are turned into medical-technical answers. The genuine pain of gender dissatisfaction that transsexualism represents has been integrated into gender conformity. Social questions of sex-role stereotyping have been integrated into psychological causal reductionisms of "dominant mother" and "absent father." Existential questions have been integrated into medical solutions of hormone treatment and polysurgery. I also examine the language of "transsexualism," a word which has the effect of deleting both the agent and object of the action (thus obscuring who does what to whom).

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Risk Assessment Using *E. coli* for Recombinant DNA Techniques

Arranged by CLIFFORD GROBSTEIN (Univ. of California, San Diego)

Thurs., 16 Feb. / Sheraton-Park / South Cotillion

3:00 p.m.-6:00 p.m.

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Stress

Arranged by JEROME E. SINGER (Uniformed Services University of the Health Sciences, Bethesda, MD)

Fri., 17 Feb. / Sheraton-Park / North Cotillion

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Some Determinants of Control of Stressful Life Events in a Community Population. BARBARA SNELL DOHRENWEND (The City College, City University of New York), JOHN L. MARTIN (Graduate Center, City University of New York).

Although stressful events can induce a wide variety of dysfunctional effects, there is evidence that their impact is less severe when the affected person believes that he can control the occurrence of the event. However, stress models relating control of aversive events to dysfunctional outcomes differ in their implicit conception of the determination of the level of control over an event, some, such as Seligman and his colleagues, attributing this level to situational contingencies and others, such as Schmale and his colleagues, to a disposition to helplessness in the person who experiences the life event. The present study addresses the question of the extent to which situational factors as against personal disposition determine perceptions of level of control over life events. It is based on reports of perceived level of control over recent life events collected from a representative sample of 167 adult residents of New York City at two times, one year apart. Results suggest that situational factors generally dominate personal disposition in determining perceptions of levels of control over the occurrence of stressful life events.

Stress, Type A Behavior, and Coronary Disease
DAVID C. GLASS (Graduate Center, CUNY)

Uncontrollable stress and the Type A coronary prone behavior pattern have been linked to the development of coronary heart disease (CHD). Initial studies in my laboratory provide systematic evidence for the behavioral components of Pattern A, namely, excessive achievement striving, a strong sense of time urgency, and hostility. Conceptual analysis of these data suggest that the behavior pattern may be a characteristic style of response to environmental stressors that threaten the individual's sense of control. The initial reaction of Type A individuals is to try harder than Type Bs to master uncontrollable stressful events. However, extended experience with lack of control under certain circumstances results in a reversal of this difference, with As showing greater decrements than Bs in their efforts at asserting environmental control. The notions of uncontrollable stress and Pattern A were also used to examine psychological precursors of clinical CHD in a field setting. A final section of the paper considers some sympathetic-adrenal medullary hormones (e.g., norepinephrine) that may mediate a relation between Pattern A, stress, and coronary disease.

Physical and Mental Health Effects of Job Loss.
STANISLAV V. KASL (Yale University), SIDNEY COBB (Brown University).

The permanent closing down of a plant where middle-aged married men have worked the majority of their adult years may be considered a socially significant, stressful event which calls for a careful longitudinal monitoring. Some 100 men went through the experience of anticipation of job loss, plant closing and employment termination, unemployment (for most), probationary re-employment and stable re-employment. Outcome variables included: indices of economic well-being, deprivation in the work role, indices of mental health & physical well-being, physiological variables, and interview-based disease indices. Stably employed controls were also studied. Selected results, using a range of outcome variables, are presented in order to: 1) document some of the health effects of this experience, 2) reveal the complex nature of the relationships, and 3) emphasize the fact psycho-biological variables which are reactive to short-term "stress" may not often show, under conditions of prolonged stress, continued reactivity leading to irreversible changes.

New Research Strategies for the Study of Stress and Somatic Illness. RICHARD S. LAZARUS (University of California, Berkeley).

Most research into the relations between stress and somatic illness follows a normative, structural model: one or two static assessments are made of stable antecedent conditions (situational or personality) and of consequences such as risk of morbidity or mortality. This approach has not succeeded well because it does not identify mediating psychophysiological processes. Research across persons must be supplemented by in-depth process-oriented, intraindividual studies. This requires new types of techniques to measure ongoing psychological processes, over time and across situations, as the person engages the environment adaptationally.

Helplessness and Stress. MARTIN E. SELIGMAN and SUZANNE MILLER (University of Pennsylvania, Philadelphia).

Behavioral Depression in Animal Models. Jay M. Weiss, (Rockefeller University).

Stressful conditions, and particularly psychological factors in stressful conditions, affect the metabolism of norepinephrine in the brain. Norepinephrine is a suspected neurotransmitter substance that appears to be important in mediating behavioral and emotional responses. Studies are presented which show that one important psychological variable in stressful situations -- the ability or inability to control stressful stimuli -- is responsible for marked differences in brain norepinephrine, with the experiencing of uncontrollable stressful events leading to possible deficiencies in noradrenergic functioning in the brain. These findings can be related to research showing that experiencing of uncontrollable stressful events leads to subsequent deficiencies in active behavioral responding, and suggests that a possible mechanism for this behavioral deficiency is the changes in central neurotransmitter metabolism that are observed to result from exposure to uncontrollable stressors.

2. ENERGY

The Impact of the Geosciences on Critical Energy Resources

Arranged by CREIGHTON A. BURK (Univ. of Texas, Austin) and CHARLES L. DRAKE (Dartmouth College)

Mon., 13 Feb. / Shoreham / Diplomat

9:00 a.m.-12:00 m.

Federal Objectives and Organizations Relative to the Geosciences. HARRISON H. SCHMITT (Member, U.S. Senate, New Mexico).

The Impact of University Geoscience Programs on Critical Energy Resources. PETER T. FLAWN (The University of Texas at San Antonio).

The impact of university programs on critical national problems comes through preparation of professional manpower, through R & D--mostly in the research end of the R & D continuum--and through a flow of academic professionals into policy positions in Federal agencies. Although university impacts are rarely visible on the national scene, in an industrial technological society, the university's human and research products are fundamental to accomplishment of national purpose. Review of current university educational and research programs in the geosciences reveals serious weaknesses of many years' standing. The most critical manpower deficiency is not in the geosciences as traditionally defined, but in the allied field of mineral technology. In the geosciences, the major weakness is in economic geology. Programs in petroleum geology and exploration geophysics are in better condition, but in 1977 recruiters met their needs with difficulty. University research funding in geosciences has lacked continuity and has been at a low level. Prospects for improvement through the new Department of Energy and through specific legislation appear good.

Hydrocarbon Resources and Related Problems. J. D. MOODY (International Energy Consultant, N.Y., N.Y.)

Fifty-five years ago U.S. crude oil resources were estimated at 14.5 billion barrels, and responsible people were quite concerned about the future of the oil industry and the economy. Continued successful exploration has resulted in the present estimate of about 300 billion barrels for the total crude oil resource base of the United States. Intensified exploration should be a major factor in attempting to cope with today's perceived shortage. Nevertheless the "energy dilemma" is real, and alternate energy sources to oil and gas must be developed. The time required for development, construction and commercial application of alternate sources of energy constitutes the energy gap, estimated at 25-30 years; for this period, oil, gas, coal, and nuclear power will be the major sources of energy. The world's crude oil resource is estimated at just over two trillion barrels; even so, the outlook is for crude oil shortages worldwide in the next 10 years. The "energy dilemma" is only a part of the "ecology dilemma", which tends to force an imbalance between energy utilization, population growth and environmental degradation. Such imbalances are not new and an example in medieval England is cited. It is concluded that a reasonable long-term solution to the U.S. energy problem will be difficult to achieve and will be achieved only at the expense of short-term relief. However, the alternatives to implementing a long-term solution to the U.S. energy problem are probably not acceptable.

Coal Resources. JACK A. SIMON (Illinois State Geological Survey, Urbana, Illinois)

The work of geoscientists has greatly advanced coal science by elucidating the origin and variability of coal, the geology of coal-bearing strata, and the characteristics and distribution of mineral constituents in coal. Geoscientists are best qualified to determine and evaluate resource, reserve, and potential recoverability data needed to assess the extent to which available minerals can meet projected needs. Coal will make an important contribution to meeting future energy needs. Significantly greater production will be required in coming decades no matter what level of energy coal ultimately provides. Attainment of goals for coal production and utilization in environmentally acceptable ways will require major efforts by geoscientists to solve a wide range of problems. Because underground coal mining in the eastern and central United States will increase, evaluation of the impact of geologic conditions on mining and productivity will become more important. Utilization of coal for gasification, liquefaction, solvent extraction, and chemical and other uses will require detailed knowledge of coal composition and variability. Geoscience can also contribute to solution of coal-related problems, such as disposal of mineral wastes from mining, processing, or utilization of coal.

Geothermal Resources--Role of the Geosciences. W. L. FISHER (Bureau of Economic Geology, the University of Texas at Austin).

In our assessment of geothermal resources and in our urgent national drive to convert these resources to producible energy reserves, the geosciences have been and will continue to be a critical key. The diverse occurrence and character of geothermal energy, ranging from convective hot water or vapor dominated systems to hot dry rock systems to geopressured systems, embraces a wide number of geoscience disciplines--plate tectonics, hydrogeology, volcanology, and facies geology, to name a few. The role of geosciences to date has ranged from delineation of major plate boundaries coincident with principal geothermal regions to the maturing of geothermal prospects in delta front sands on the down side of Gulf Coast growth faults. When the full potential of geothermal energy is realized, it will primarily have been the result of basic geoscience research and development.

Nuclear Energy Resources. LEON T. SILVER (California Institute of Technology, Pasadena, Cal.)

Political and social decisions have had profound influences on the recent perception of the potential demand for nuclear energy resources. A scientific evaluation of these resources must recognize that society desires information not only to the questions, "Where is it?" and "How much?", but, also, "How much will it cost?", "When can it be produced?", What cost to the environment?", and much more. The geological and mineral sciences and the mining industry are now challenged to provide both comprehensive information and judgment from a knowledge base that stagnated for more than a decade because of national disinterest in supporting continued basic research into the geology and geochemistry of uranium and thorium. The renewed Federal interest in nuclear resources has reversed this trend but intensive large-scale research and exploration efforts are required to meet the presently perceived demand for these resources from the still inadequately defined resource base. These efforts are within the capabilities of the U.S. geological sciences community if mobilized effectively.

Energy Development and Environmental Protection: The Role of the Geosciences. PRISCILLA C. GREW (Department of Conservation, State of California).

Traditionally we have largely relied on geosciences to facilitate the exploration phase of developing our petroleum, coal, uranium, and geothermal resources. As the nation uses lower-grade domestic resources on an increasingly larger scale, we must increasingly rely on the geosciences in mitigation of the environmental impacts of massive energy resource production. Examples of areas where geosciences are essential are: (1) reclamation of coal strip mines; (2) protection of ground and surface water resources during oil shale and coal production; (3) mitigation of water resources impact of geothermal energy development; and (4) safe underground disposal of nuclear wastes. The geosciences are also essential to ensuring the environmental safety of major energy production and transportation facilities, such as in the protection of: (1) nuclear and hydroelectric systems from earthquake hazards and (2) major pipelines from natural hazards such as permafrost and fault offset.

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Efficient Comfort Conditioning (Heating and Cooling) of Buildings

Arranged by WALTER G. BERL and W. RICHARD POWELL (Applied Physics Laboratory, Johns Hopkins Univ., Laurel, MD)

Mon., 13 Feb. / Sheraton-Park / Dover

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Solar Comfort Conditioning. FREDERICK H. MORSE, Research and Development Branch, Conservation and Solar Applications, Department of Energy, Washington, D.C.).

The partial substitution of solar energy for fossil or nuclear energy for comfort conditioning of buildings has the potential for significant national energy savings in the near future. Solar energy may be used to heat and cool building spaces using varying degrees of mechanical sophistication. At one end of the spectrum are the passive heating and cooling techniques; using the building itself to collect, store, and distribute the heat or to reject the heat for cooling. Heating may also be accomplished by forced circulation of air or a suitable liquid through thermal flatplate collectors. The most mechanical complex approach to solar heating is the use of a heat pump, assisted or driven by solar energy.

Solar cooling may also be accomplished through a variety of techniques, having a similar range of complexity as for solar heating. Once again the simplest methods are the passive; night sky radiation and evaporative cooling. At the opposite end of the spectrum, mechanically and thermodynamically, is the operation of absorption and rankine-cycle chillers at the high temperatures achievable with concentrating collectors. Between these two cooling approaches are many others; including the use of desiccants, and the operation of modified absorption and rankine-cycle machines.

The various ERDA supported projects based on these technologies will be summarized in this paper.

Results of OTA Evaluation of Solar-Based Efficient Comfort Conditioning and Recommendations. DR. HENRY KELLY (Office of Technology Assessment, US Congress, Washington DC)

The potential for using a variety of types of solar and conventional onsite energy equipment for meeting the energy requirements of a small residential community will be examined. The study will examine systems employing a range of heat engine designs operating with and without waste heat recovery and with and without solar energy inputs. The study also examines the possibility of using photovoltaic arrays to meet community energy needs and the possibility of using the thermal output of concentrating collectors coupled with photovoltaic devices. Both commercial equipment and speculative future equipment will be examined. It will also examine a number of techniques for storing and transmitting energy including the possibility of using centralized low-temperature storage facilities, and the possibility of storing thermal energy at higher temperature in rock formations. The study will review technical feasibility, economics, and social and environmental impacts.

The Effect of Solar Heating and Hot Water Design Strategies on Future Market Acceptance. G. E. BENNINGTON (The MITRE Corporation), P. C. SPEWAK (The MITRE Corporation).

This paper presents current cost/performance relationships for solar heating and hot water systems and projects probable cost/performance relationships which may be achieved with currently envisioned technology. Based on these projections, three alternative design objectives are postulated: 1) Minimum $\$/f^2$ per given efficiency; 2) maximize efficiency within cost constraints; 3) maximize efficiency within size constraints. The results show that alternative two yields the lowest cost on the basis of initial system cost; alternative three provides the lowest cost in terms of dollars per million Btu. The cost/performance results were then used with the MITRE/METREK market penetration algorithm. This algorithm estimates consumer's propensity to buy solar systems based on the maturity of the technology, the initial cost of the solar system, and the annual savings which may be realized through the use of solar systems. It was determined that alternative two would have the largest market penetration impact even though system three provided lower cost energy (and higher annual savings).

Economic Analysis of Demand and Conservation Relative to Efficient Comfort Conditioning. ROBERT THOMAS CROW (Electric Power Research Institute, Palo Alto, Calif.)

Thermal efficiency has been overemphasized as an objective of energy policy and technological development. It does not take account of the differential scarcity of energy sources, e.g., sunshine vs. natural gas; nor does it take account of the scarcity of non-energy resources. Furthermore, attempts to optimize on thermal efficiency run a risk of ignoring important non-energy aspects of product quality. Consumer choice aspects of space conditioning are discussed, as are social choice aspects. Tentative system comparisons are advanced, keeping in mind that it is the purchaser of the comfort conditioning system that must be satisfied and that thermal efficiency rarely enters directly into consumers' balancing of first cost, operating and maintenance cost, and qualitative aspects of a system.

Optimal Design of Seasonal Storage for 100% Solar Heating. J.G. ASBURY, J.V. CARUSO, R.S. GIESE and R.O. MUELLER (Argonne National Laboratory, Argonne, Ill.)

This paper reports the results of an engineering design and economic analysis of solar heating systems that incorporate alternative thermal energy storage technologies. Seasonal storage systems are designed to have capacities adequate to meet worst-case insolation outage conditions, thus eliminating requirements for a backup energy supply technology. Generic systems analyses as well as hour-by-hour simulations are used to examine sizing and operating trade-offs between major system components. Detailed engineering estimates of costs and technical feasibility for a number of specific seasonal storage designs will also be presented.

Design and Experimental Results of Photovoltaic-Thermal Cogeneration System Installed in Solar One and a Residence.

KARL W. BÖER (University of Delaware and SES, Inc., Newark, Delaware, 19711).

A photovoltaic-thermal cogeneration system for partial solar electrification and comfort conditioning, interfaced with the electric power utility grid, is described. A heat pump is used for air conditioning, and solar assisted, for supplemental heat. A first experimental house, Solar One, built in 1973 and implementing some of the features is analyzed during its first three years of operation.* Conclusions drawn from its operation lead to the development of a first residential cogeneration system which was partially completed in 1976/7. One wing of this residence is "heated" by a low temperature system with essentially zero driving force via a copperfoil embedded in the double outside walls of the house and kept near room temperature by pipes fed with heat from an indoor pool, used for heat storage. This permits the use of low temperature roof collectors with maximum thermal and photovoltaic conversion efficiencies. First experimental results are reported and analyzed in respect to performance (conversion efficiency, solar vs. conventional energy utilization, maintenance) and payback of first cost.

*K.W. Böer, J.H. Higgins and T.K. O'Connor, Proc. 10th IECEC Conf. (IEEE-printing) Delaware (1975), pg. 7 ff.

Community Energy Systems - The Promise of Tomorrow.

GERALD S. LEIGHTON (Office of Conservation and Solar Applications, Department of Energy).

Communities, now experiencing rising energy costs, are faced with providing community services in a manner that maintains a high standard of living, is environmentally acceptable, and provides consumers with price-stable, reliable services. The objective is to do this and conserve energy. Two elements of community energy systems which have significant energy-saving potential are cogeneration and land use planning. Cogeneration is broadly defined as the joint production of more than one energy good. Key to the development of cogeneration community energy systems is the element of community design and land use planning, which allows for the optimal spatial arrangements of facilities to reap the benefits of integrated systems.

Program activities of Federal agencies engaged in these efforts are discussed, including the programs of the Department of Housing and Urban Development, the Council on Environmental Quality, the National Science Foundation, and the Department of Energy. The initial comprehensive efforts at DOE are directed at the Grid-Connected Integrated Community Energy System. In this system the electric utility partnership alleviates some of the initial restrictions concerning franchise arrangements. It further allows for the maximization of energy use efficiency by allowing for thermal demand control with unrestricted electricity interchange between the system and the utility network. The system is designed to serve communities with heating, cooling, and electricity. It is well along toward initial operation in the early 1980's.

Electric Utility Load Management.

ROBERT G. UHLER (Electric Power Research Institute).

Comfort conditioning loads have contributed to the growth in peak demand as well as the increased peakedness of some systems' load patterns. Utilities have responded by adopting or evaluating various load management strategies including, for example, new rate designs, energy storage, new energy using equipment, and load control techniques. For two years, a major research effort--the Electric Utility Rate Design Study--has been devoted to a broad investigation of these relationships. The research to date has indicated that many forms of load management are technically feasible. However, cost-effectiveness is highly utility specific because of generation-mix, local weather conditions, load characteristics, etc. The results of the research to date and on-going research are summarized in the paper.

CASES Simulation.

W. RICHARD POWELL (Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland 20810).

An hourly simulation analysis of the Community Annual Storage Energy System, CASES, is discussed. CASES consists of a two-stage heat pump, various energy storage facilities and an Environmental Energy Exchanger, EEE, for transferring thermal energy to and from the environment. Numerous second-stage, water-source heat pumps are located throughout the CASES community. These heat pumps are used only for heating and take warm water (~15°C) from one pipe of a two-pipe distribution system and return cold water (~5°C) to the other pipe. Cooling is provided simply by allowing water from the higher pressure cold main to flow through building heat exchangers at a flow rate which returns it isothermally to the warm main. Thus the central CASES plant supplies only the net warm or cold water required. Ice produced by central, ice-making heat pumps during periods when a net warm water demand is not satisfied from short-term storage is saved in an annual storage facility for "energy-free" air conditioning of the community. The short-term, warm-water storage facility is recharged at off-peak electric rates or "energy-free" by either the EEE or the community during periods of net cold water demand. CASES appears both economical and very efficient.

The Application of District Energy Systems to U.S. Urban Areas.

JAMES R. POWELL (Brookhaven National Laboratory)

In the last few decades district energy systems have been widely used in a number of European countries using waste heat from electric generation or refuse incineration, as well as energy from primary sources such as geothermal wells or fossil fired boilers. The current world status of district energy utilizations is summarized. Cost and implementation projections for district energy systems in the U.S. are discussed in comparison with existing modes of space conditioning and domestic water heating. A substantial fraction, i.e., up to ∿ one-half of the U.S. population could employ district energy systems using waste heat, with present population distribution patterns. U.S. energy usage would be reduced by an equivalent of ∿30% of current oil imports. Detailed analyses of a number of urban areas (including New York, Chicago, Philadelphia, etc.) are used to formulate conceptual district energy supply systems. potential implementation levels, and projected energy costs. Important national ancillary economic and social benefits are described; and potential difficulties relating to the implementation of district energy systems in the U.S. are discussed. District energy systems appear very attractive for meeting future U.S. energy needs. The technology is well established. The cost/benefit yield is favorable, and the conservation potential is significant. District energy can be applied in urban and densely populated suburban areas. The remaining demand, in rural and low population density communities, appears to be better suited to other forms of system substitution.

A Review of the HUD Total Energy Experience at Jersey City, N.J.

JEROME H. ROTHENBERG (Department of Housing and Urban Development).

In the early 1970's, the Dept. of HUD undertook a program to develop utility delivery mechanism for housing. One specific thrust of this program is the integration of power generation and environmental conditioning - Total Energy - into the multifamily sector. The National Bureau of Standards performed a feasibility survey of HUD Operation Breakthrough sites to determine which sites would be suitable for implementation of a highly instrumented total energy system, the Summit Plaza Development at Jersey City, N.J., was selected. The site consists of 486 residential units, plus other space. The plant provides electricity, hot water for space heating and domestic hot water, and cold water for air conditioning. The site occupancy started in 1974, and the total energy plant was operating then. In addition, the site includes a Pneumatic Trash Collection (PTC) System which collects all solid waste from the site. The site was heavily instrumented and data collected and reported for a one-year period from November 1975 to October 1976. Both technical and economic data are collected. This data and the plant analysis will be reported. In addition, HUD has investigated the feasibility of on-site incineration of the collected solid waste with recovery of the heat in an existing boiler. This and other modifications to the plant will be discussed.

Space Conditioning in Sweden LEE SCHIPPER, (Lawrence Berkeley Lab. and Guest Researcher, Royal Academy of Sciences Stockholm)

A comparison of space heating practices in Sweden and the US is made, and it is seen that the intensity of heating in Sweden, expressed in Joules/degree day/sq. meter is remarkably lower there than in the US. Several reasons for the difference are noted-insulation practices, windows, lower infiltration rates, building materials all differ significantly in Sweden from those in the US. It is noted that district heating, a large proportion of which is made available in conjunction with the production of electric power, accounts for about 20-30% of all heat delivered to apartments. However, it is then shown that because apartments in Sweden are for the most part not metered directly for heat, these systems are far less efficient in practice than in theory. Even if the heat is considered "waste heat" from a power plant, the cost of piping and the not-insignificant amount of electric power production foregone to produce hot water at the desired outlet temperature make the use of district heating less attractive than otherwise. Moreover, it is suggested that the Swedish example of building construction makes the reduction of heat loads in the US extremely attractive so much so that a large scale district heating system, or other smaller capital intensive heat production systems may be unprofitable compared with heat load reduction. Thus it is suggested that while the Second Law of Thermodynamics may provide a good guide to possibilities for reducing heating demand, other techniques that do not change the thermodynamics of the production of heat may prove more economic and energetically attractive.

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The Socioeconomic Impacts of Energy Development

Arranged by FRANK CLEMENTE (Pennsylvania State Univ.)

Mon., 13 Feb. / Sheraton-Park / Assembly

3:00 p.m.-6:00 p.m.

SOCIAL IMPACTS OF ENERGY DEVELOPMENT IN THE WEST. STAN L. ALBRECHT (Brigham Young University).

As a result of large-scale energy development, much of the western portion of the United States is changing from a traditionally rural, agriculturally oriented society to a rapidly urbanizing, industrialized area. Coincident with this change are the benefits and, more particularly because of the rapidity of the development, the costs associated with industrialization. Three sets of variables are identified as critical in predicting the magnitude of the social impacts of this energy development. These include first, the characteristics of the existing community such as size prior to the development, demographic history, social and cultural homogeneity, degree of social and geographic isolation, and the range, mix and quality of the existing infrastructure. Second, the characteristics of the in-migrating labor force are important including size, permanence, and social, cultural, and demographic characteristics. Finally, the rate of growth is critical in affecting the ability of the community to adjust. Each of these factors is illustrated through the utilization of data from communities already being impacted by energy development.

Attitudes and Expectations Toward Western Energy Development. RONALD L. LITTLE (Utah State University).

Mineral extraction and processing as well as energy production and transmission has been well documented for the Rocky Mountain and Great Basin states. The social and economic consequences for residents of the small and frequently isolated communities near large-scale energy developments have, unfortunately, not been equally well documented. Even though intuitive projections have been made, scientific studies have all too frequently focused upon macro-economic issues, ignoring the equally crucial social issues. The paper examines the attitudes and expectations of residents dwelling in communities impacted by both mineral extraction (coal, uranium, oil and natural gas) and energy production (hydroelectric and coal-fired generation). Interviews with 479 household heads residing in six communities in Arizona, Montana, and Utah provide the data. While the communities differed in the degree of exposure to energy developments, the attitudes and expectations toward the various projects are remarkably similar across communities. Observed variations were found along lines of age, occupation, religion, degree of urbanization and local culture. Respondents tended to view development positively. They failed to forsee significant negative consequences, and tended to ignore potential social problems.

Toward Ending the Inattention: A Report on The Social Consequences of Energy Boomtown Development. WILLIAM R. FREUDENBURG (Yale University).*

Although boomtown problems have been the focus of an increasing amount of attention in recent years, we still know surprisingly little about the actual human consequences of boom developments. This paper briefly lists some of the reasons for the relative inattention, and then summarizes the author's research, which was designed to help close the gap. The research included approximately 1000 interviews, the use of publicly-available data, and over a year's worth of first-hand, ethnographic observation in four western Colorado towns at one stage or another of energy-related development; the paper describes some of the overall trends that became visible during the course of that observation. Most notable are the consequences for the informal social patterns of the community: small (pre-existing) groups of friends tend to persist with very little change, but in what is probably the most characteristic single consequence of the large-scale, rapid impact process, the informal arrangements of a community-wide level are essentially destroyed. Some of the consequences of this process are noted.

*The author would like to express his appreciation to the National Science Foundation for providing partial financial support for this research.

Socioeconomic Consequences of Nuclear Power Plant Developments. RICHARD S. KRANNICH (The Pennsylvania State University).

With the passage of the National Environmental Policy Act in 1969 a legislative mandate was established to assess "socioeconomic" as well as environmental consequences of large-scale development projects. However, the developing literature base in the area of socioeconomics has exhibited a pronounced tendency to stress social and economic pathologies associated with the so-called "boom town" syndrome. While boom growth and associated problems do appear to provide relevant conceptualizations of the socioeconomic impacts of energy resource development projects in geographically isolated sectors of the western United States, the argument is presented that such a perspective is generally inappropriate when assessing the consequences of nuclear power plant developments. Survey data on twenty-one nuclear generating facilities are analyzed in order to provide a comparative perspective on socioeconomic consequences and factors which influence their relative importance.

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New Batteries in Energy Use of the Future

Arranged by REUBEN S. TITLE (IBM Research Center, Yorktown Heights, NY)

Tues., 14 Feb. / Sheraton-Park / Dover

9:00 a.m.-12:00 m.

Fast Ionic Transport In Solids. ROBERT A. HUGGINS, Stanford University, Stanford, California 94305.

An increasing number of solids are now recognized as having especially large values of ionic conductivity. The unusual characteristics of such "fast ionic conductors" will be reviewed and the special structural features leading to this behavior will be discussed. When large values of ionic conductivity are accompanied by very low electronic conductivity such materials may be used as solid electrolytes in a number of potential applications. Materials such as beta alumina, for example, can act as electrochemical transducers in both scientific and technological systems containing a variety of monovalent cations. Of particular interest is the possibility of their use in high specific energy and specific power battery systems. Electronically conducting solids which also exhibit fast ionic transport can have unusually large values of the chemical diffusion coefficient and in some cases this can lead to the possibility of their use as solid solution electrodes in new types of batteries or fuel cells, electrochromic display systems, etc.

High Energy Sodium-Sulfur Batteries: From 32-Watt Hour Laboratory Cells to Megawatt Batteries for Load Leveling. WALTER L. ROTH (General Electric Corporate Research and Development).

High energy density secondary batteries are attractive for their potential to conserve energy by load leveling electric power systems. During the past decade many advances have been made over a broad front of science and technology which show a high temperature battery fueled by sodium and sulfur is technically feasible. The key to the Na-S battery is the solid electrolyte known as beta alumina. It is a crystalline solid with great chemical and thermal stability and an exceptionally high conductivity for sodium ions. The mechanism of sodium transport and the chemical and structural factors which control conductivity in beta alumina have been elucidated by studies of the structure and the motion of sodium ions with x-ray and neutron diffraction and nuclear magnetic resonance. Small 32-watt hour cells have been cycled thousands of times without failure and the phase changes and transport of electrically active materials observed by high temperature radiography while the cells were discharged and charged. The next critical stage is assembling cells into moderate sized batteries and evaluating economic parameters for determining if Na-S batteries will be cost competitive with alternate batteries and pumped hydro systems for energy storage.

The Lithium-Titanium Disulfide Battery System. ROBERT P. HAMLEN (Exxon Enterprises) and LEWIS H. GAINES (Exxon Enterprises)

Titanium disulfide is representative of a new type of high-egergy density battery cathode based on solid state electrode reactions. The inherent properties of TiS_2 which appear to provide an attractive, reversible cathode for lithium batteries are: (1) excellent room temperature rate capability together with a high theoretical energy density of 215 Wh/lb when coupled with a lithium negative; (2) substantial insolubility in organic electrolytes; (3) high electrical conductivity; (4) an attractive cost level; and, (5) a charge-discharge mechanism involving only the intercalation (insertion) of lithium ions between the TiS_2 layers. The inherent rate limitation of practical pressed powder electrode structures lies in diffusion of Li^+ in the organic solvent, rather than in the solid electrode. Consequently the rate performance of Li-TiS_2 batteries can be brought to high levels by attention to the mass transport properties of the electrode and separator designs.

Because the battery operates at ambient temperatures, relatively inexpensive construction techniques and materials can be used. EEI projects that when applied in a vehicle with a range of 100 miles, a lithium-titanium disulfide battery system could deliver 60 Wh/lb at a manufacturing cost of approximately $35/kWh in large volume production. These values compare favorably with current extended cycle life lead acid battery technology which provides an energy density of approximately 10 Wh/lb at a comparable energy cost.

New Batteries for Electric Utility Systems of the Future. JAMES R. BIRK (Electric Power Research Institute)

Battery energy storage is one of the few options available to the electric utility industry to replace oil and gas for meeting peak demands. In addition, batteries are expected to have versatile operational characteristics, environmental compatibility, and few siting constraints. These prospects have given rise to broad and growing activities in R, D, & E of advanced battery concepts. To date, technical feasibility of several advanced batteries has been demonstrated. The big questions are: Can reliable batteries be built from cells and can batteries be made economically competitive with other utility options?

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Economic Growth With/Without Energy Conservation

Arranged by CHARLES J. HITCH (Resources for the Future, Washington, DC)

Tues., 14 Feb. / Sheraton-Park / Continental

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

The Imperative of Energy Conservation for Economic Growth. JOHN H. GIBBONS, Environment Center, University of Tennessee.

In the industrialized world energy and capital have now mostly displaced human and animal labor, per se. No plausibly higher energy prices in the U.S. will cause bulldozers to be replaced by wheelbarrows. However, the turnaround (c.1972) of long term downward trending energy prices does imply a need to utilize energy more efficiently in the future. Higher efficiency of use by more careful housekeeping, by substitution (e.g., use of insulation and improved combustion control in place of fuel purchases), and by modification of behavior (e.g., set-back thermostats). These several responses, collectively called "end-use conservation", reflect the fact that given time for a response to occur, energy is a highly substitutible input to provision of amenities. A given standard of living does not dictate a given amount of energy consumption. Since energy is substitutible the extent to which it should be conserved depends upon its price relative to alternative actions to provide an amenity. Without conservation energy prices (assumed to be higher at the margin) will escalate more rapidly, retarding growth. Furthermore, if the U.S. and other industrialized nations do not adopt energy conservation practices (largely through the substitution of ingenuity and sophistication for brute-force energy consumption) then the opportunities for developing nations to achieve growth goals will soon be seriously compromised.

Consistency of Economic Growth and Energy Conservation Technology. CHAUNCEY STARR (Electric Power Research Institute).

The principal concern of this paper is whether technology can be expected to permit the simultaneous achievement of economic growth and conservation objectives. Generally, forecasting and planning models do not take explicit account of technological possibilities in assessing the prospects of energy conservation. Conservation scenarios of several forecasting efforts are analyzed to make rough estimates of conservation due to technological change separate from conservation due to other factors. The technological change component is then compared to the expected impacts of known and prospective energy conservation technologies in order to assess whether technology is likely to be sufficient to meet the conservation objectives. Problems of implementing technological change and implications of shortfalls between the policy objectives and technological feasibility are discussed. Finally, some cautionary comments are provided on the dangers of relying too heavily on energy conservation technology as a means of reducing energy consumption.

Energy and Full Employment. W. W. Rostow (The University of Texas at Austin).

As in the other four periods over the past two centuries when the prices of basic commodities rose in relative price, the key to both structural adjustment and full employment lies in shifting the direction of investment towards the expansion and conservation of supply of the commodities experiencing relatively high prices.

With respect to the contemporary issue of energy, the question is not simply: What minimum supply of energy, in combination with what maximum realistic measures of conservation, is consistent with full employment? The question is also: To what extent would a realistically balanced U.S. production and conservation program itself help bring about conditions of full employment, since many types of conservation (as well as energy production) are capital-intensive? This paper seeks to answer that latter question.

In contemporary United States, however, an answer must be disaggregated by regions for two reasons: unemployment rates, as well as regional structural problems, are not uniform; the regions differ in both energy resource endowments and in their potentialities for energy conservation. The paper thus makes an effort to measure the contribution energy-related investment can contribute to reduced unemployment and accelerated growth in the regions as well as in the aggregate behavior of the national economy.

Energy Conservation and Economic Well-Being: Lessons of History and Other Countries. JOEL DARMSTADTER (Resources for the Future).

To link energy conservation to economic well-being requires a more precise formulation of the meaning of conservation than is frequently encountered. An obvious distinction must be made, for example, between conservation governed (a) by economic analysis and relative price considerations or (b) by other, nonmarket criteria for energy use. History can be used to illuminate energy-economy relationships: the hoped-for energy-GNP "decoupling" is sometimes proposed as an entirely novel departure. In fact, much of the twentieth century witnessed a progressively falling U.S. energy-GNP ratio. Intercountry comparisons of energy use and national output can alert us to opportunities for enhanced efficiency of energy use, as well as remind us of less easily transferable foreign experiences. Finally, a useful distinction can be made between energy consumption occasioned by rising incomes (e.g., household use, private cars) and energy consumption that is a springboard for rising incomes. The latter deserves special focus in relating energy conservation to employment and output.

Inescapable Interrelationship Between Energy Consumption, GNP, and Employment Levels. MIKE MCCORMACK, U.S. Congress.

There has been a direct relationship between annual growth rates for GNP, employment levels and energy consumption in the United States since the end of the Second World War. The correlation is so close that the assumption of an interrelationship between these indices is unavoidable. Therefore, while every rational attempt must be made to eliminate waste in energy consumption, it must be recognized that this nation cannot deliberately and significantly reduce energy consumption growth rates without impacting GNP and employment levels. The future economic stability of this nation depends upon energy policies which will, while eliminating waste and protecting the environment in every reasonable way, provide for a dramatic increase in domestic energy production capacity between now and the year 2000.

Post-Petroleum Prosperity. Denis Hayes (Worldwatch Institute).

Even most skeptics now concede that we should begin a speedy transition to a post-petroleum economy. Hopefully, some of our finite oil stocks will be preserved for non-energy uses by future generations. An abrupt weaning from our most widely used fuel will have sweeping social, political, and technical consequences. No alternative energy source promises to be as inexpensive as the oil on which our economy was built. However, numerous theoretical studies, the Japanese and European experiences, and simple common sense all suggest that a healthy economy can coexist with high energy prices. Materials, labor, and the fruits of human ingenuity will be increasingly substituted for expensive fuel. The principal economic threat is not to efficiency but to equity; public policies must ensure that the poor are not forced to shoulder a disproportionate burden.

The Fable of the Elephant and the Rabbit?. ALAN S. MANNE (Stanford University).

This paper presents an aggregate analysis of energy-GNP interactions. The results underscore the importance of two parameters: (1) the relative size of the energy sector, and (2) the elasticity of substitution. These appear to be the dominant factors in conservation policy and in energy demand model design.

A Preliminary Assessment of the Potential to Adjust Capital Stock to Higher Energy Using Efficiencies. ROGER W. SANT (Carnegie-Mellon Institute of Research).

This paper describes an approach for determining the economic and technical potential for adjusting capital stock to higher energy using efficiencies and outlines some preliminary results. An integrating tool is used to draw together some original work in the industrial sector with some existing data in the buildings and transportation sectors to derive energy demand forecasts. The approach explicitly recognizes the "supply" side of the demand forecasting problem. An evaluation of existing capital stock and energy flows is developed. A technical assessment is then made of the physical changes that potentially can be made to the capital stock and the cost and energy savings of each of those incremental changes is determined. The preliminary findings are that approximately $300 billion (in 1976 dollars) of capital stock adjustments are justified on the basis of current marginal costs of energy. This investment is shown to have the potential to save 20 quads of 1976 energy use. A further assessment of the decision makers in each sector indicates, however, that no more than half of that potential would be realized without significant changes in policy.

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Renewable Energy Resources: Modeling of Complex Realities

Arranged by MAXINE L. ROCKOFF (Natl. Center for Health Services Research, Hyattsville, MD)

Tues., 14 Feb. / Sheraton-Park / Dover

3:00 p.m.-6:00 p.m.

Quantitative Aspects of Tidal Power. GEORGE F.D. DUFF (University of Toronto).

Harnessing of tidal energy in the Bay of Fundy and Passamaquoddy Bay is now under study in the U.S.A. and Canada. Numerical modelling of oceanographic partial differential equations is used to predict resonant amplitude changes due to tidal barrier construction. Studies include siting and design using one, two or more tidal basins and combinations of turbine and sluice gate capacity. Retiming of intermittent power blocks involves double or multiple basins or orchestrated power systems operation to compensate for daily and monthly tidal cycles. Motion and deposition of sediments is difficult to predict but wind waves and ice formation can be allowed for. Also involved are geological and foundation studies including storage pressure induced earth tremors. Environmental effects involve drainage of marsh lands, fish and waterfowl population changes, intertidal zone and migratory bird species. Pumped water storage basins and ship canal design must also be considered. Improved straight flow turbine design and construction techniques suggest economic cost prospects at highest amplitude sites. A pilot project at Annapolis Royal, Nova Scotia is now being prepared. There are northern sites in Ungava and Cook Inlet, and several potential tidal power sites in other continents, so this mode of electrical energy generation may play a part in the future.

Wind Energy Parameters. MARVIN R. GUSTAVSON (University of California)

Increased interest in the utilization of wind energy has led to a proliferation of estimates of the potential magnitude of this renewable energy source. Here the solar energy dissipative processes which are the source of wind energy are examined and used as a basis for analysis. Estimates are derived for the maximum tolerable rate of wind energy extraction both globally and on a United States only basis. This permits a critique of alternate bases of estimation which generally have suggested much larger values. It also permits some general conclusions to be reached on siting opportunities and a comparison of wind energy extraction with other renewable energy sources.

Compatibility of Renewable Energy Resources and Long Term Economic Growth. WILLIAM W. HOGAN (Stanford University)

The traditional availability of low cost but nonrenewable energy is cited frequently as the source of our past economic growth. This raises the question of the economic impact of a long run transition to possibly more expensive renewable energy resources. The recent study of the long run relation between energy and the economy conducted by the Energy Modeling Forum provides a partial answer to this question. Higher energy costs reduce the potential economic growth of the economy but the substitution of other economic inputs makes this economic impact less than the historical analogy might indicate. These results are presented in the context of a transition to renewable energy resources.

Analyzing Potential Markets for Renewable Energy Resources. EDWARD H. BLUM (Department of Energy)

For all energy supplies, the moment of truth lies not so much in the laboratory or in production as in the marketplace. To achieve a notable impact, once it can be transformed into useful energy, a resource must compete successfully for end-use market share. A renewable source - such as tidal power electricity - must compete not only with nonrenewable sources (such as oil, gas, or coal-fired generating plants) but also with other renewable sources available at the same time (such as wind-generated electricity, solar-thermal electricity, photovoltaic systems, and biomass-fueled electricity generation). This paper describes several analyses of potential markets for renewable energy resources conducted at ERDA and underway at the Department of Energy. These examine potential markets in detail - e.g., low-temperature heat, mid-to-high temperature heat, direct mechanical work, centralized and decentralized electricity generation, intermediate fuel forms (solid, liquid, gas); all are examined for new and retrofit applications, for major geographic regions, and for various futures. Overall performance includes system considerations (e.g., resource collection, transmission, distribution, storage, backup, redundancy), as these differ greatly among the various uses of renewable and non-renewable resources. As much as possible, these analyses attempt to project who might use renewable resources, where, when, and why. The paper also notes how these analyses are used to help assess priorities, emphases and phasing for energy R&D, incentives, and regulations.

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A Report of the National Academy of Sciences' Committee on Nuclear and Alternative Energy Systems

Arranged by HARVEY BROOKS (Harvard Univ.)

Wed., 15 Feb. / Sheraton-Park / Continental

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Overview of the Study. HARVEY BROOKS, E. L. GINZTON (Varian Associates, Palo Alto, Cal.) and JACK M. HOLLANDER (National Research Council, Washington, D.C.).

Energy Demand and Conservation. JOHN H. GIBBONS (University of Tennessee, Knoxville).

Alternative Energy Supply Systems. W. KENNETH DAVIS (Bechtel Power Corporation, San Francisco, Cal.) and FLOYD L. CULLER (EPRI, Palo Alto, Cal.).

Social and Economic Considerations: Energy Modeling. LESTER B. LAVE (Carnegie-Mellon University) and TJALLING C. KOOPMANS (Cowles Foundation for Research in Economics, Yale University).

Risks and Impacts of Alternative Energy Systems. JAMES CROW (University of Wisconsin, Madison), JOHN HARTE (Lawrence Berkeley Laboratories, University of California, Berkeley) and DAVID SILLS (Social Science Research Council, New York, N.Y.).

The Role of Nuclear Energy. BERNARD I. SPINRAD (Radiation Center, Oregon State University, Corvallis), DAVID ROSE (MIT), and JOHN P. HOLDREN (Energy and Resources Program, University of California, Berkeley).

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Exploring A Rationale for Long-Term R & D Investments in Inexhaustible Energy Resource Technologies

Arranged by ROBERT NATHANS (State Univ. of New York, Stony Brook)

Thurs., 16 Feb. / Sheraton-Park / Dover

9:00 a.m.-12:00 m.

....Why the Federal Role in Inexhaustible Energy R&D. DR. STEPHEN RATTIEN (Donovan, Hamester and Rattien, Inc.)

As the world's fossil energy resource base approaches depletion--particularly oil and gas--and as U.S. fossil-fuel self-sufficiency seems ever more remote, the ultimate need to shift the Nation's and the world's energy system to inexhaustible sources becomes ever more apparent. Research into a wide variety of inexhaustible technologies is moving forward under a number of auspices both here and abroad--both private sector and governmental. This presentation will discuss the rationale for Federal Government participation, indeed leadership, in many areas of inexhaustible energy R&D--ranging from conservation (in most senses an equivalent to an inexhaustible energy source) to fusion, with key components in various forms of solar energy. Issues to be discussed include economics, risk, social responsibility, environmental and other externalities, non-capturability of some forms of R&D, first costs, regulatory factors, role of demonstrations, and length of lead times.

What the Relative Mix of Technology Investments in the Inexhaustibles: A Government View. BENNETT MILLER (Department of Energy, Washington, D.C.)

On The Timing and Selection of The Inexhaustible Energy Sources. ROBERT L. HIRSCH (Exxon Research & Engineering)

The inexhaustibe energy resources (solar, fusion, breeders) are treated as a class because they can potentially supply energy for thousands of years or more, because they involve significant institutional issues, and because they will be expensive to develop and/or deploy. The inexhaustibles are believed by many to be needed as quickly as possible because of problems associated with the availability and environmental effects of alternate energy sources. A vigorous national program of ten years duration is recommended in order to develop solar and fusion to the point where working systems and detailed analysis can serve as a basis for making intelligent comparisons with breeders leading to a decision as to which technology(s) should be deployed. In order to understand the inexhaustibles, each separate technology (photovoltaics, wind, biomass, DT fusion, fission-fusion, LMFBR, GCFR, etc.,) are separately considered; comments are provided on status, advantages and disadvantages, economics, probable contribution, and outlook.

Solar Energy Research: A Rational Policy Has Yet To Emerge. ALLEN L. HAMMOND (AAAS).

Federal Support of solar energy research has not been consistent with the potential of the resource either in the magnitude of the effort or the goals adopted. A rational allocation of energy research dollars would give far more emphasis to certain solar technologies as near- to mid-term candidates than they have yet received. At the same time the federal solar R&D budget is large enough and is being spent in such a way that private risk capital has been largely driven out of the field. A critique of the federal solar R&D goals is offered and a comparison of the potential of several solar technologies to other energy technologies is made in terms of the state of research and budget allocations.

The Role of Inexhaustible Energy Technology in the Global Context. JAMES W. HOWE (Overseas Development Council)

Most of the people in the world live in the developing countries. From 50 to 90 percent of the people in developing countries live in rural areas. The vast bulk of their energy comes from traditional (non-commercial) sources such as wood, dung, draft animals and crop residues. Very little modern energy enters their economic life. But global accounts of energy produced and consumed are confined to commercial energy. Traditional energy is omitted. Hence the energy of the rural Third World is left out of these estimates and extrapolations from the current energy consumption base to (say) the year 2000 likewise leave them out. There is therefore an implicit assumption in all global energy projections that rural Third World people will still rely chiefly on traditional energy in the year 2000. Yet the international community has an increasingly accepted goal of eliminating the worst aspects of human poverty by the year 2000 and that is not consistent with continued dependence on traditional energy. The 25 developing countries that have succeeded in eliminating the worst aspects of poverty (this will be defined) have followed a path of development based on use of petroleum. If the goal of eliminating gross poverty is to be achieved by all developing countries with the same pattern of petroleum intensity, the result would be to increase dramatically world demand for oil. This makes exploration of small-scale renewable energy technology for the rural areas of the Third World especially important.

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Life-Cycle Costing in Energy Conservation

Arranged by S. S. PENNER (Univ. of California, San Diego)

Thurs., 16 Feb. / Sheraton-Park / Dover

3:00 p.m.-6:00 p.m.

Life Cycle Costing for Energy Conversion Technologies. JOHN A. BELDING (ERDA/Office of Conservation)

Life Cycle Costing concepts can provide a bridge between technology developers, commercial suppliers and final users. ERDA Energy Conservation programs use LCC techniques to focus our development work on market acceptance criteria. CONRT programs aim at increased energy conversion efficiencies and multi-fuel opportunities in many varied industry settings. Examples are given: heat cycles, heat exchangers, materials, combustion, etc. Engineering/technical development must be cost-centered and realistic; lifetime costs account more fairly for better performance and energy efficiency than other methods. Difficulties in applying LCC are discussed.

Is Zero Energy Growth Feasible in the Residential Sector? ERIC HIRST (Oak Ridge National Laboratory, Oak Ridge, TN 37830)*

This paper examines the effects of government regulatory, incentive, and research programs on residential energy use and household economics during the 1977-2000 period. The basis for these evaluations is a detailed engineering-economic model of residential energy use developed at ORNL. Results of these analyses suggest that future trends in residential energy use are subject to considerable control. The range of estimated energy use in the year 2000 is 15-30 QBtu.

A judicious combination of government regulations (appliance efficiency standards, thermal standards for construction of new residences), incentives for weatherization of existing homes, and research & development to produce new technologies can yield a future in which residential energy use in the year 2000 is at roughly the present level. Such a combined program could also provide large economic benefits to households. That is, the reduction in the present worth (at a real interest rate of 8%) of fuel bills between now and 2000 could exceed the extra costs of more efficient equipment and structures by $25 - $50 billion.

*Work supported by the U.S. Department of Energy under contract with the Union Carbide Corporation.

Future Automotive Fuel Economy. H. L. STADLER, W. M. BREHOB, J. E. AUILER, R. H. BORCHERTS. (Ford Motor Company)

An examination of the potential of future improvements in automotive fuel economy by changes in aerodynamic drag, rolling resistance, weight, hybridization and improvements in engine efficiency. A discussion of the practical problems of achieving the extremal values of these parameters that have been suggested or demonstrated will also be offered.

An Example of Life-Cycle Costing as a Metnod of Procurement. N. B. MCEACHRON, D. C. HALL, and L. F. LEWIS (SRI International, Menlo Park, Cal.)

Life cycle costing (LCC) is one of a number of procurement incentives being considered by civilian government agencies to improve the cost-effectiveness and technological quality of procured products and systems. A framework for selection of products or systems, industries, and agencies to which LCC is appropriate is presented. The LCC procurement of home appliances by the General Services Administration (GSA), assisted by the Experimental Technology Incentives Program (ETIP), illustrates the development of this framework and the dollar benefits obtainable from LCC procurement. The example also reveals the importance of prior assessment and ongoing evaluation to implement and improve procurement methods.

Life-Cycle Costing for Energy Conservation in Industrail Industrail Processing. T. V. LONG (Com. on Public Policy, Univ. of Chicago).

"Life Cycle Costing and Realistic Goals for Energy Conservation". JOHN H. GIBBONS (Director, Environment Center, University of Tennessee).

Evidence is now abundant that as energy prices rise, compared to prices of other goods and services, there are a variety of possible responses that can be used to provide amenities with less energy. In other words, energy is substitutible to a surprising degree. One reason for this fact is that efficiencies of most existing energy-consuming capital stock are an order of magnitude less than limits imposed by the second law (of Thermodynamics). Because of this the energy efficiency can be considerably increased for new product design with only a small increase in production cost (design, engineering, manufacturing).

While major increases in efficiency can thus be achieved, especially in new capital goods, the initial investment will likely be higher, albeit offset over the life of the equipment by smaller energy purchases. Therefore, the theoretically achievable and economically sensible goals for conservation must be moderated to reflect the realities of costs and availability of capital to finance consumer purchases.

Life cycle cost analysis is needed to provide purchasers with quantitative information that discloses their "best buy" in the trade off between capital investment (for efficiency) and energy purchases. Such information is currently only available in very special circumstances. Two surrogates for such market signals are premium loans and minimum performance standards, based on life cycle cost analysis.

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Federal Energy Policies: Future Directions

Arranged by JOHN C. SAWHILL (New York Univ.)

Fri., 17 Feb. / Sheraton-Park / Continental
9:00 a.m.-12:00 m.

U.S. Energy Goals for 1985--Can We Get There from Here? FRANK ZARB (Exec. Vice. Pres., Shearson, Hayden, Stone, N.Y.).

U.S Nuclear Policy--An Assessment and Next Stages. JOSEPH S. NYE (Dep. Under Sec. of State for Internat. Security).

Energy Policy--An International Perspective. MELVIN CONANT (Consultant, Washington, D.C.).

Priorities for Energy Research and Development Policy. ROBERT FRI (Consultant, Washington, D.C.).

3. TOOLS OF SCIENCE

Photography and Imaging as Tools of Science

Arranged by W. E. GARRETT, BRIAN HODGSON and JULIE GAMBLE (National Geographic Magazine)

Mon., 13 Feb. / Sheraton-Park / North Cotillion
9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Clinical Use of CT Scanning. DAVID O DAVIS, (George Washington University Medical Center).

Computerized Tomography (CT) is a relatively new tool for evaluation of human disease. In its earliest form, it was largely limited to the evaluation of brain disorders, but now all portions of the body can be scanned by these techniques. The reconstructed digital images have a flexibility that allows considerable gain in information when compared to the older methods. Future uses of this technique in emission (radic-nuclide) and ultra-sound scanning show considerable promise in both the clinic and the laboratory.

Noninvasive Dissection and Three-Dimensional Display of the Structure and Function of Bodily Organs Using Dynamic Spatial Computerized Tomography. RICHARD A. ROBB, ERIK L. RITMAN, EARL H. WOOD (Mayo Foundation).

A new generation, fully electronic and very rapid whole-body computerized tomographic system has been designed and is currently under construction in our laboratory to provide accurate noninvasive visualization and measurement of the dynamic changes in shape, dimensions and positions of the heart and lungs and of the blood flow to, from, and within these and other organ systems of the body. This Dynamic Spatial Reconstruction System (DSR) will produce complete simultaneous scans of up to 240 cross sections in 0.01 seconds, at a repetition rate of 60 complete scans per second. The feasibility and practicality of the DSR system has been demonstrated by a currently operational prototype assembly, from which full three-dimensional dynamic reconstructions of the thorax and its contents of experimental animals have been obtained. These 3-D images can be mathematically dissected by the computer into multiple parallel thin sections oriented at any desired angle to the body, and then displayed so as to permit nondestructive detailed examination of the regional structure and function of the organ(s) under study. The DSR system will provide important, new clinical diagnostic capabilities for study of cardiovascular and pulmonary disabilities and for detection of the many disease processes, such as cancerous tumors, which distort the three-dimensional vascular anatomy, distribution of blood flow or other dynamic circulatory functions in any region of the body.

Kinetic Radionuclide Imaging. NICHOLAS G. NOLAN, (Washington Hospital Center, Washington, D.C.)

Radionuclide-labeled pharmaceuticals can be used to study a variety of physiologic functions in man. By choosing appropriate agents, it is possible to selectively examine the brain, bone, lung, liver, kidney, heart, and many other organs. Gamma photons emitted from the administered radioisotope are detected by a scintillation camera. This device also localizes the origin of each photon in terms of its x and y coordinates. By collecting hundreds or thousands of these events, an image of nuclide distribution is created. These data are then digitized and are transferred to a computer for analysis and storage. Kinetic functions are studied by assembling a sequence of these images. Time can be effectively expanded or contracted by varying the rate of data playback. Thus, a rapidly occuring process, such as the passage of blood through the heart, can be displayed in slow motion. In this way, events which are too rapid to be seen by the eye are revealed. Similarly, slow physiologic processes, such as the accumulation of iodide in the thyroid gland, can be viewed in speeded-up form allowing detection of events too gradual to be otherwise seen. A number of examples of clinically useful applications of these techniques will be presented and discussed.

Cardiac Catheterization and Angiography. H. BRANDIS MARSH, M.D. (Washington Hospital Center)

Cardiac catheterization is a technique in which catheters (plastic tubes) can be inserted into the heart in living, fully conscious patients. Insertion and manipulation of the catheters is performed under X-ray observation. Since soft tissues of the heart all absorb X-ray with equal effiiency, a simple X-ray will not distingush different cardiac structures. A materal which absorbs X-ray efficiently must be injected through the catheter to delineate structures of interest. This technique is termed "angiography." It will visualize heart chambers, valves, and coronary arteries, and is used commonly for making diagnoses and evaluating patients prior to open heart surgery. The X-ray image is formed on a phosphorescent screen. After amplification through an image intensifier tube, the image is processed in two ways. For immediate viewing the image is transmitted through a closed circuit television system and displayed on video monitors. For permanent recording and high resolution work the image is recorded directly on motion picture film. Technical aspects of the procedure and the imaging systems will be discussed and representative films will be shown.

The Use of Videotape in Medicine. HANS SCHNEIDER, M.D. (Capitol Hill Hospital, Washington, D.C.)

Image intensification in combination with a T.V. system provides the radiologist with an improved tool for all diagnostic fluoroscopy. Videotape permits the storage and review not only of stationary fixed images similar as on an x-ray film but also of the motion, pulsation and peristalsis of the structures within the body.

This is accomplished without interference of the primary viewing by the radiologist and with no additional radiation for the patient or examiner.

Various examples of this technique with and without contrast media will be shown. (G.I. studies bronchography and angiograms.)

Recent Developments in Pediatric Endoscopy. STEPHEN L. GANS (Cedars-Sinai Medical Center)

The medical profession has long been keenly aware of the advantages of inspecting the inside of hollow organs and cavities which could be approached through an orifice. The limiting factor in pediatric endoscopy has always been the size of the instruments. Conventional endoscopes have been adequate for adult procedures, but when reduced in size for pediatric patients the field of view becomes very small making orientation difficult and the image less than satisfactory. Because of this, large numbers of endoscopic examinations in infants and children have been unduly prolonged, repeated or even abandoned with the attendant risk and danger. Two recent technical advances have done much to alleviate this situation. The development of fiber optic principles resulted in both brilliant and dependable illumination, and the achievement of a satisfactory image through a flexible endoscope. The advent of the new Hopkins rod lens optical system, made it possible to miniaturize rigid endoscopic instruments which provide clear, magnified, wide angle images and capabilities never before possible. This not only makes procedures shorter, more accurate and safer and thus less demanding on a critically ill patient but photographic documentation and education are readily available.

Media As A Tool For Social Change. TIMOTHY W. KENNEDY (Cornell University)

A presentation will be given on the use of video and film technology as they were employed in the experimental SKYRIVER PROJECT which was carried out in the Lower Yukon village of Emmonak, Alaska, from 1970 until 1973.

Video and film were used as "tools" to strengthen an open-ended community development process that successfully effected social change within and between Alaskan Eskimo villages. The SKYRIVER PROJECT also provided a process of direct communication between Alaskan Eskimo villagers and government decision makers. All aspects of the process will be discussed and representative issue films will be shown.

Photography and Remote Sensing in the Polar Oceans. JOSEPH B. MACINNIS (Undersea Research Limited)

Since 1970, the author has directed nine expeditions to the Arctic in order to study the physiological, psychological and operational aspects of men working beneath the polar oceans. 715 dives were conducted at 27 dive sites, including the North Pole. During each expedition, still and motion pictures were used to record all aspects of the dives. Occasionally, closed-circuit television and physiological telemetry systems were used to record diver function during extreme stress situations.

New Developments in Underwater Photography and Their Role in Deep Sea Research. DR. ROBERT D. BALLARD (Woods Hole Oceanographic Institution).

Deep Sea photography had its beginning in the 1930's with the pioneering work of William Beebe on mid-water life. The first photographs of the deep seafloor, itself, were obtained a few years later by a group of scientists under the leadership of Maurice Ewing, who continued their efforts during World War II; applying their scientific experience to the identification of wrecks. In the post-war era developments in underwater photography continued into the early 1960's, producing much of the technology used by the marine scientific community today. Very little happened during the intervening decade to improve upon this technology base until the early 1970's when large integrated and well-financed oceanographic research programs were initiated. Beginning with the detailed investigation of the Mid-Atlantic Ridge, using submersibles and surface-lowered cameras in 1970, and continuing with similar projects today, the state of underwater photography and its role in marine research has undergone rapid development. These new techniques, however, are only being used by a few scientists and have yet to be adopted by the larger marine community, which is only now learning of their existence. These new systems include ones used from the surface, as well as by scientists within deep diving submersibles.

Finding and Exploring The U.S.S. MONITOR. HAROLD E. EDGERTON (M.I.T., Cambridge, Mass. 02139)

The location of the Civil War wreck, U.S.S. MONITOR, lost in 1862 off Cape Hatteras during a storm has been the goal of many people. The availability of special sonar devices in the past few years has made the search a technical possibility. John Newton, then with Duke University Marine Lab, Beaufort, N. C. organized a group to search the historical records for the most probable areas where the MONITOR might be found. Six locations were listed, the first being considered the most probable. Next, he organized a group of people with oceanographic, geological, navigational, photographic and TV capabilities to work as a team on the Duke University R/V EASTWARD during August 1973. A ship, thought to be the MONITOR, was located by this team in 220 ft. of water. The TV records, a subsequent photomontage of the wreck by the Navy's ALCOA SEAPROBE, and the finding of a deck cover proved beyond a doubt that the MONITOR had at last been located. (See John Newton's article in the National Geographic Magazine, January 1975.) The most recent study of the MONITOR, July/August 1977, was made by the Harbor Branch Foundation under the direction of NOAA (Office of CZM, U. S. Department of Commerce). Underwater cameras mounted on a Link/Johnson submersible were used to take stereo pairs to prepare a three dimensional plan. A camera/strobe system lost in the first expedition of 1973, a piece of the bottom plate, and a red signal lantern were brought to the surface.

Photography and Its Use in Search and Recovery Activities. ROBERT E. KUTZLEB (Seaward, Inc.)

The location and recovery of valuable items from the ocean floor has often involved underwater photography. Starting with the H-Bomb recovery off Spain in 1966 and including last year's F-14 recovery off Scotland, still, motion picture and television cameras have been invaluable aids in the successful completion of these projects.
The author will describe the various techniques available as well as the roles they can play. Depending on the water depth, which has been as deep as 15,000 feet, cameras may be diver-held, submarine-mounted, towed on a moving sled or mounted on a tethered vehicle. While not the primary tool in object location, photography has often been a key element. Once an object is located, a decision must be made on the method of recovery. In this area, underwater photography has been a vital contributor, showing the object's condition, and possible points of attachment. In certain cases where recovery has been impossible due to physical properties, or resulting costs, photography was again a key factor. Accident investigators have been able to determine the cause of an aircraft accident from underwater photographs or films.

Space Technology in Underwater Exploration. JAMES R. EDBERG (Jet Propulsion Laboratory, California Institute of Technology)

A concerted effort is being made at the Jet Propulsion Laboratory of the California Institute of Technology, encouraged and supported by the National Aeronautics and Space Administration, to apply space program derived techniques and technology to the solution or amelioration of non-space problems. Within this broad-based Civil Systems Program, a relatively new effort is directed at the ocean, the Ocean Technology program. Of particular interest here is the application of digital processing/image enhancement techniques to underwater images, both photographic and acoustic. Operations possible include the suppression of "noise", contrast enhancement, distortion removal, slant range corrections, and cartographic mosaicing. On a limited basis, these operations have been applied to both underwater photographs and side looking sonar with highly encouraging results.

High-Speed Photography of Random-Moving Objects. GREGORY A. DALE (Yorktown High School).

My experimentation has been in the field of infrared and pulsed laser sensing devices which facilitate detection of insects or other random moving objects passing through a plane and activating a high-speed shutter attached to a camera. In addition, I designed and built a programmable sequential strobe trigger which permits multiple exposure photos to be made when used in conjunction with my sensing device. The photos can then be analyzed to determine speed and flight characteristics of an object.

In operation, an infrared LED or laser diode is pulsed to emit an infrared beam of approximately 910 nm. The pulsing beam has the advantage of making the receiver less susceptible to ambient light. A sensitive receiver capable of sensing objects as small as .2 mm in diameter detects and amplifies the transmitted beam. The receiver employs threshold and missing pulse detection circuitry to sense an interruption of the infrared beam.

In addition to the plane detection system, this device has several other modes of operation. A straight line of detection can be used to ranges greater than 1000 ft. Also, two intersecting beams with coupled receivers can form a point detection system.

Photographs taken with this system have permitted detailed observations of high-speed objects. Some multiple exposure photos with known time intervals have revealed wing and flight characteristics of insects.

Holography - Its Application to Information Storage. DAVID R. SCOTT and ALBERT E. PREYSS.

For almost two decades, the principals of holography have been known to offer potential dramatic advances in the practical uses of optical imaging. Recent advances in technology have enhanced the applications of this photography by laser in the area of information storage and retrieval. The basic characteristics of the hologram are described, followed by an explanation of its application to optical mass data storage. The advantages offered by holographic technology over conventional mass data storage systems are discussed in terms of improvement of existing requirements and expansion into the increasing demands for information storage.

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Computers as Tools in Science

Arranged by RAYMOND E. DESSY (Virginia Polytechnic Institute and State Univ.)

Tues., 14 Feb. / Sheraton-Park / Assembly

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Benefits and Burdens of Intelligent Instruments. JAMES T. ARNOLD (Varian Associates, Inc.)

The microprocessor offers the promise of low cost proliferation of automated, so-called intelligent instruments. The inevitable generation of a great number of very capable instruments will be a mixed blessing during a transitional period. On the benefit side, features of automatic management of complex procedures, high speed data handling, relief of operator attention and economic replication will increase explosively the quantity and quality of scientific and industrial data. These benefits will be accompanied by burdens, perhaps most importantly of intelligent utilization planning. In a way, the scientific and industrial community faces a management problem in the near future to direct in a coherent way an enormously expanded capability to generate information. Utility is inescapably dependent on a deep understanding of the questions addressed by the automated instrument. Despite the capability of the microprocessor component, the successful automated system design must be, if anything, more elegant and more sophisticated than its manually operated predecessor. The challenge to the system designer, if burdensome, is also exhilarating as a result of the latitude given by microprocessors and their high speed digital accompaniment.

Laboratory Networks, Protocols, and Languages. R.E. DESSY (Chemistry Department, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061).

In the next few years most scientific laboratories will be analyzing their automation needs in terms of the best use of existing automation equipment and with a careful consideration given to future expandability and flexibility. Networks provide a rational approach to solving both of these considerations and the necessary software and hardware is becoming increasingly available. Various components of a DEC LSI-11 microcomputer network will be discussed. Details of various protocols will be presented. Several case histories illustrating how to choose computing elements to match the experiment or task requirements will be developed. The languages supported by these systems will be compared and current trends in procedural oriented languages will be analyzed.

Real Time Computing in Neurobiology. HOWARD MORAFF (Cornell University), PAUL B. BROWN (West Virginia University).

Since the discovery of the electrical activity of nerve cells over a hundred years ago, neurophysiologists have pioneered in advancing the development and use of electronic instrumentation for scientific experiment. That pioneering tradition has also seen neurophysiologists make many significant contributions in advancing scientific applications of computers.

In the early days of computing, their uses in neurophysiology were mainly those of off-line data analysis and simulations. Innovative investigators have added a wide range of on-line and real-time capabilities, with direct connection of the computer to the experiment, and advances in methods of signal analysis, pattern recognition and image processing.

Current developments include the incorporation of new technologies in special purpose laboratory peripheral devices, and the development of new hardware and software tools for pattern analysis in neurophysiology and neuroanatomy. An effort is under way to develop a general purpose computer system for neurophysiologists.

A View of the Future: Computer Hardware and Software. RICHARD CASE (IBM)

A review of the advances of the last 25 years in computer technology and applications, a look into the research and advanced development projects which may lead to future advances, and a projection of the next 25 years of change. Areas considered include applications, logic, memory, storage, printing, and programming. A final section briefly explores the potential social impact of this rapidly-changing technology.

Scientific Applications of Pattern Recognition Techniques. PETER C. JURS (Department of Chemistry, The Pennsylvania State University, University Park, PA 16802)

Pattern recognition and cluster analysis comprise a set of methods for approaching data analysis problems drawn from many areas of experimental science. These techniques allow the detection and recognition of invariant properties among sets of measurements. Sets of measurements taken on previously tested and labelled objects can be analyzed and classifiers developed for later use in prediction of unknowns. Often the most important independent variables can be identified. The techniques have special utility because the data can have a large number of independent variables per object and can come from unrelated sources. Pattern recognition methods have been applied to the following areas: spectral analysis - elucidation of chemical structure from spectroscopic data; materials science - classification of materials as to origin or suitability, e.g., archaeological artifacts; classification of complex mixtures - analysis of fingerprint data for material identification, e.g., petroleum samples, biological materials; modelling of chemical experiments; structure activity studies - searching for relations between molecular structures of bioactive compounds and their bioactivity classifications, e.g., drugs, agricultural chemicals, chemical communicants, mutagens, carcinogens. Some recent examples drawn from these areas will be presented to illustrate the variety of uses of pattern recognition in scientific data analysis.

Computer-Aided Organic Synthesis, An Example Applicable To Biology and Biophysics. W. TODD WIPKE (Board of Studies in Chemistry, University of California, Santa Cruz,CA 95064)

The purpose of a computer-assisted design program is to help the chemist visualize, explore, and evaluate the space of possible syntheses of a given target molecule. The computer and chemist form a problem-solving team, with each member contributing special skills. Contributions from the computer include memory of many complex reactions, freedom from bias of previous solutions, speed, accuracy, and completeness. A movie will illustrate the operation of this system. Application in other areas will also be discussed.

Computers In Diagnostic Cytologies. PETER H. BARTELS (University of Arizona, Tuscon, AZ 85721), GEORGE L. WIED (University of Chicago, Chicago, IL 60637)

The visual diagnostic assessment of cytologic and pathologic clinical samples is aided and made more discriminating and objective by digital computation. High resolution microscopic images are digitized. Cell image properties such as the distribution pattern of the nuclear chromatin are extracted and used as features to recognize and classify cells and tissues automatically. Computer methods offer more than mere quantitation; it has been possible to show that computation is capable of extracting information which is visually not perceived, e.g. the parameters of higher order stochastic dependencies of the measured gray values. Computer analysis of microscopic clinical samples thus truly extends our capabilities of diagnostic perception. The Ticas Software Package with its self-learning capabilities is being applied to a wide range of clinical cytologic problems such as the automation of cervical cancer detection, the differentiation of normal, atypical, and malignent urophilial cells, material from lung cytology. An important application is the study of lymphocyte populations. It is possible to discern between B and T lymphocytes, and even several subpopulations within each of these immunological active cells. The effect of radiation, chemotherapeutic infectious agents, and exposure to environmental pollutants may be objectively measured.

Data Base Management and Its Impact on the Research Scientist. MARTHA WILLIAMS (Department of Information Science, University of Illinois, Urbana, Ill. 61801)

The multiplicity of data bases available in the field of chemistry including bibliographic, numeric, and representational data bases will be discussed. The relationships between these data bases in the commonality of the data elements in these data bases will be shown in order to indicate the potential for mapping routes from one file to another file. The interconnections between the files can be exploited assuming the existence of a computer readable directory and network connections between files. The impact of available data bases and their interrelationships on the research scientist will be explored.

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New Tools for Viewing the Universe

Arranged by BEVERLY T. LYNDS (Kitt Peak Natl. Observatory) and MORTON ROBERTS (Natl. Radio Astronomy Observatory)

Wed., 15 Feb. / Sheraton-Park / Assembly

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

The Next Generation of (Ground-Based) Optical Telescopes. L. GOLDBERG (Kitt Peak National Observatory).

The dramatic growth of astronomy over the past three decades has been paced by the development of new techniques for the detection of radiation at all wavelengths and by the establishment of observatories on space platforms well beyond the boundaries of the earth's atmosphere. Whereas astronomers were once limited to observing the Universe within the narrow band of visible wavelengths, they now have access to the entire electromagnetic spectrum. Far from diminishing the value of ground-based optical telescopes, the revelations from previously hidden regions of the spectrum have greatly enhanced their importance by suggesting crucial observations at visible wavelengths. A number of large ground-based telescopes have recently been placed in operation by astronomers from many countries in both northern and southern hemispheres and still others are under construction. At the same time a revolution in detector technology has made these telescopes many times more efficient than was the 200-inch telescope when it began operating 25 years ago. It is anticipated that within 10 years the efficiencies of detectors will approach 100%, which implies that further gains can only be achieved by increasing telescope apertures. Preliminary studies suggest that equivalent apertures up to 25 meters are technically feasible and not exorbitant in cost. A number of competing concepts for such a next generation telescope will be described.

Infrared Telescopes, C. H. TOWNES, (University of California, Berkeley.*

The vigorous development of infrared astronomy during the last one or two decades has depended strongly on new technical developments in solid state physics, electronics, cryogenics, and space work, but on telescopes and approaches to observing designed primarily for optical work. During this time its importance to astronomy and its versatility have become increasingly clear. There is now an established base of knowledge and techniques which makes appropriate both more refined and in some cases larger-scaled instruments which are directed specifically towards exploitation of the infrared region. The applicability of this region to astronomical problems will be discussed along with the more important directions of development needed and new instruments, including in particular types of telescopes, appropriate for the coming one or two decades.

*Work supported in part by NASA Grant NGL 05 003 272.

New Radio Astronomy Tools for Viewing the Universe. D. S. HEESCHEN (National Radio Astronomy Observatory*)

Several major new instruments for viewing the universe at radio wavelengths are under construction or in the design stage. Chief among these is the Very Large Array, now being built in New Mexico. One to two orders of magnitude more powerful than any existing radio telescope, it is expected to provide a wealth of exciting new opportunities for probing the depths of the universe. The development, present status, and expected performance of the array are described. While the VLA will operate at centimeter wavelengths and provide spatial resolution to about 0.1 arc sec, other new instruments are needed to improve our view of the universe at still shorter wavelengths. Several interesting telescopes and interferometers are under construction or being planned in both Europe and the U.S. which will considerably extend our observing capabilities at millimeter and sub-millimeter wavelengths. These are briefly reviewed. Finally, some of the current ideas for further exploiting the powerful technique of very long baseline interferometry, which has already yielded milliarcsecond spatial resolution and which may have important applications in geodesy and geophysics as well as in astronomy, are discussed.

*Operated by Associated Universities, Inc., under contract with the National Science Foundation.

Scientific Programs with Space Telescope. LYMAN SPITZER, JR. (Princeton University Observatory).

The NASA Space Telescope, recently authorized by Congress and scheduled for launch into Earth orbit in late 1983, will be a powerful general-purpose tool for optical space astronomy. With an aluminized mirror 2.4 meters in diameter, it will provide stellar images with half their total energy within circles about 0.04 arcsecond radius, smaller by more than an order of magnitude than is available from the ground under the best conditions. Launched and maintained by the Space Shuttle, this telescope should have a useful life measured in decades, with updating of its instrumentation possible every few years. The specific instruments planned will be discussed, together with the chief scientific programs which they make possible, including research in such major fields as cosmology, stellar evolution, galactic structure, interstellar matter and planetary atmospheres.

Prospects for X-ray Astronomy in the Near Future
EDWIN M. KELLOGG (Center for Astrophysics, Harvard College Observatory/Smithsonian Astrophysical Observatory)

X-ray astronomy has been most rewarding so far, leading to the discovery of new objects such as black holes in stellar systems and massive extragalactic gas clouds in clusters of galaxies. These have been discovered with relatively unsophisticated X-ray photometers. In the near future we will begin observing celestial objects with imaging X-ray optics. The HEAO-B observatory has optics with 2" resolution over a 10' field, and 1' resolution over a 75' field. It is also equipped with spectrometers of $\lambda/\Delta\lambda \sim 10$ to 10^3. This telescope will improve our sky survey sensitivity by about 10^3, which corresponds to a ratio of ~30 in distance. It will allow us to extend our studies of neutron stars, supernova remnants, and black holes from our own to more distant neighboring galaxies, and to detect extragalactic X-ray sources at cosmological distances. For example, we can expect to see X-rays from hot gas clouds in clusters of galaxies at $z \sim 1$. This is tantalizingly close to the epoch at which we believe galaxies were forming ($z \sim 2$-4) out of the void after the Big Bang. Therefore, the prospect of another more powerful X-ray telescope, of 1.2-meter aperture, is very appealing. Such a telescope will have ~ 20 times the sensitivity of HEAO-B due to recent advances in detector technology. This telescope, launched by the Space Shuttle, can provide an extremely powerful X-ray observing capability to the astronomical community for about ten years.

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Patterns of Invention

Arranged by ROLF M. SINCLAIR (NSF)

Thurs., 16 Feb. / Sheraton-Park / South Cotillion
9:00 a.m.-12:00 m.

Cyclotrons and How They Grew. M. STANLEY LIVINGSTON (Mass. Instit. of Tech., Retired).

The principle of cyclotron resonance conceived by Ernest O. Lawrence in 1930 was the essential invention which led to the development of the cyclotron. In brief: In a uniform magnetic field light ions traverse circular orbits at a constant frequency depending on the magnitude of the field. If the radiofrequency applied to the accelerating electrodes is in resonance with the ion frequency the ions are accelerated at each turn, with orbit radius and energy increasing to maximum at the periphery. As a Doctoral student I demonstrated the validity of the principle in the Spring of 1931. The first working cyclotron produced protons of 1-MeV energy and was used to disintegrate atomic nuclei early in 1932. A larger machine produced 5-MeV deuterons by 1934 and supported the growing Radiation Laboratory. By 1939 the "Crocker" cyclotron was completed which soon attained the maximum practical energy of 20-MeV deuterons. This rapid development was the result of a sequence of technical improvements made by a number of young scientists trained at Lawrence's laboratory. One was the utilization of magnetic and electric focusing during acceleration; another was the condensed arc discharge used as an ion source; others used improved radiofrequency design and higher power sources to provide acceleration. However, the rapidly developing "state of the art" in scientific and engineering technology was primarily responsible for the speed of development of the cyclotron.

Patterns of Invention, C. H. TOWNES, (University of California, Berkeley.

While inventions originate in diverse ways, the maser and laser represent almost a text-book case of invention growing out of academically-oriented basic research, development by fast-moving applied science interests, and the resulting creation of important tools both for industry and for further advances in research. This development will be reviewed with discussion of its context, conceptual bottlenecks and the emergence of necessary ideas, views of the field during its development, financial support, and interplay between different components of the scientific and technical community.

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The New Ion Microscopies: Progress and Prospects

Arranged by WALTER L. BROWN (Bell Laboratories, Murray Hill, NJ)

Thurs., 16 Feb. / Sheraton-Park / Assembly
3:00 p.m.-6:00 p.m.

Proton Microprobe Elemental Analysis of Specimens in Air. PAUL HOROWITZ (Harvard University), LEE GRODZINS (Massachusetts Institute of Technology), and JEAN RYAN (MIT Lincoln Laboratory).*

The properties of charged particle microbeams for scanning microspectrometry via induced x-ray energy analysis, particularly a)sensitivity for the detection of trace elements, b)penetrating power and use with samples in air, c)fundamental and practical limits of resolution, and d)choice of optimum particle energy, are described and compared for electrons, protons, and heavy ions. Some recent applications of a 2 MeV emergent-beam scanning proton microprobe are shown, including problems from geochemistry, materials science, medicine, biology, and physiology. Of particular interest is the unique ability to perform spatially-resolved trace element analysis of single strands of hair, and of frozen hydrated specimens, illustrated with examples from poisoning victims and kidney physiology.

*Supported by the National Science Foundation, the Energy Research Development Administration, and the Air Force.

Results with a High Resolution Proton Scanning Microscope. R. LEVI-SETTI, W.H. ESCOVITZ and T.R. FOX (University of Chicago).*

Field ionization of H_2 by a (111) oriented W tip, cooled by a cryostat to 78°K, provides a source of H^+ and H_2^+ ions of high brightness, adequate to operate a high resolution scanning microscope. With a prototype single focusing and accelerating stage (gun-microscope), micrographs of biological specimens were obtained at a resolution of ~ 1000 Å, operating in the transmission mode at 55 - 65 kV. We are presently attempting to reach the limiting resolution of the gun-microscope (~ 300 Å). A systematic exploration of the contrast mechanisms accessible to proton microscopy is in progress. The earliest micrographs were obtained by total and critical range absorption in specimen layers 40 - 60 μg/cm² thick (myofibrils, human metaphase chromosomes). Good contrast in thin specimens (20 - 100 Å thick) such as unstained erythrocyte membranes was obtained using the elastic scattering signal (bright field) and the hydrogen ion neutralization signal (charge-exchange). The latter is a new contrast mechanism unique to ion microscopy which we are investigating for its potential in the detection of hydrogenated low-Z compounds. We are now implementing an improved detection system which includes a magnetic sector spectrometer and a secondary electron detector.

*Research supported by the National Institutes of Health and the National Science Foundation.

Progress on a High-Resolution Secondary-Ion Microprobe. G. R. RINGO and V. E. KROHN (Argonne National Laboratory).*

Secondary ion microscopy offers several advantages over autoradiography in following tracer isotopes particularly in potential resolution (100 Å vs 1000 Å) and in variety of isotopes which would be useful. To achieve this potential resolution a source of high brightness is needed. We have developed such a source which works by the field evaporation of ions from the tip of a cone of liquid gallium. This source has given brightnesses as high as 10^6 A cm^{-2} $ster^{-1}$

and should give currents of 6×10^{-11} A on a spot 150 Å in diam. With a large high resolution mass spectrometer this should permit tracer concentrations lower than 1 part in 10,000 to be located, in favorable cases, in the sense of being assigned to one type of structure rather than another. In general, negative secondary ions would be used and their yield enhanced by evaporation of cesium on the target. Double labelling of materials with for example ^{13}C and ^{2}H, and looking for appropriate molecular ions - $^{13}C\,^{2}H^{-}$ in this case, would enhance sensitivity. Probably ^{14}C is the best possible tracer. It has a very low natural background, availability in many compounds and relatively low radioactivity. Unless $^{14}N^{-}$ ions are even rarer than expected however it will require new detection methods such as stopping power measurements or 2-photon absorption of laser light to identify $^{14}C^{-}$.

*Work performed under the auspices of the National Institutes of Health and USERDA, Div. of Physical Research.

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Mathematics: Tool of Science

Arranged by ALFRED B. WILLCOX (Mathematical Association of America, Washington, DC)

Fri., 17 Feb. / Sheraton-Park / Assembly

9:00 a.m.-12:00 m.

Applications of Mathematics in the Physical Sciences. PETER D. LAX (The Courant Institute of Mathematical Sciences, New York University).

The availability of large computers has placed many mathematical theories within striking distance of practical answers; at the same time it has created a voracious demand for new, efficient algorithms. This has created a golden opportunity for mathematicians to develop new mathematics to help solve problems of science, applied science and technology. In this talk some examples of recent mathematical successes will be presented, as well as some problems now facing us in the physical sciences whose resolution depends on advances in mathematical techniques and theories.

Applications of Mathematics in the Life Sciences. ROBERT M. MAY (Biology Department, Princeton University).

Mathematical models are increasingly being used in studies which aim to shed light on the dynamical behavior of populations of plants and animals. I will try to illustrate this with some examples of models that combine non-trival mathematics and empirical data. Such examples include: (i) aspects of the dynamics of insect host-parasite systems; (ii) the transmission dynamics of tropical helminthic and protozoan infections (e.g., filariasis, schistosomiasis, malaria); (iii) the dynamics of grazing ecosystems and other harvested systems; (iv) factors influencing the complexity, diversity and relative abundance of faunal communities. Throughout, particular attention will be paid to nonlinear phenomena, and their consequences for "thresholds", "breakpoints" and alternate stable states, and "chaotic" solutions.

Mathematics in an Industrial Setting. GORDON RAISBECK (Arthur D. Little, Inc.).

In an industrial setting, mathematics is rarely practiced by itself, but there are many opportunities to use mathematics effectively in conjunction with an understanding of operations, engineering, and other branches of science, both social and physical. The industrial mathematician should soon be an effective journeyman, if not a master, in one or more non-mathematical areas of importance to his employers and colleagues. What the industrial mathematician must do is much influenced by what his non-mathematical colleagues think mathematics is. This may include many things which a university faculty of mathematics might exclude or ignore, such as parts of many modern disciplines like operations research and information theory, parts of other sciences and branches of engineering like hydrodynamics and electromagnetic theory, and applications of 17th, 18th and 19th century mathematics which still have economic importance. Knowing how and when to apply known mathematics efficiently and correctly is more important than research toward new methodology and techniques. Formulation of problems arising in a non-mathematical context and presenting solutions so that non-mathematicians can implement them are essential.

Applications of Mathematics in the Undergraduate Program. MAYNARD THOMPSON (Indiana University).

Both conventional and not-so-conventional methods of conveying the subject matter knowledge and the spirit of applied mathematics at the undergraduate level are surveyed. Recent and ongoing projects concerned with identifying and developing appropriate materials and settings will be discussed.

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Research Reporting with Tomorrow's TV and Computer Graphics

Arranged by DAVID TRIANTOS (Naval Research Laboratory, Washington, DC

Fri., 17 Feb. / Sheraton-Park / Assembly

3:00 p.m.-6:00 p.m.

Computer Graphics. FREDERICK R. BROOME (US Census Bur., Suitland Md.) and LAWRENCE E. CORNISH (US Census Bur.)

A prime feature in using any future reactive audiovisual communication network for research reporting will be computer-generated graphics. The computer graphics setup that the Census Bureau is now using for graphics such as demographic maps that are to be printed would readily serve more directly as a source of graphics to be transmitted electronically over a communication network. We will show, in a videotape presentation, our present computerized methods of generating graphics and will discuss the ongoing changes to make the setup even more automated. In our paper we will comment further on the content of our videotape presentation, discuss how computer graphics would be handled by a future electronic journal to be both produced and transmitted via tomorrow's reactive TV network, and discuss the feasibility in general of a reactive communication system that would replace present communication systems.

Communicative Capabilities of Visual Literacy. FRANCIS M. DWYER (The Pa. State Univ., State College, Pa.)

The presentation will emphasize the importance and the effectiveness of visual literacy as a communicative medium in complementing oral information. Research relating to the instructional effectiveness of different types of graphics (visual illustrations) in facilitating learner achievement will be summarized. Strategies which can be employed to increase the communicative potential of different types of graphic material (visual illustrations) will also be discussed.

Interactive-Telecommunication Policy Issues. PETER CLARKE (Univ. of Mich., Ann Arbor)

At Michigan we have been studying policy issues surrounding telecommunication services for 4 years. Recently we have developed interactive cable services designed to improve occupational skills and worker productivity. Our setting is the Rockford, Illinois, elementary schools, where we have inaugurated cable programming for teachers, accompanied by interactive polling and immediate feedback of response comparisons. The 2-year project involves teachers in 42 schools. Before-after interviews are gathering data about changes in teachers' behavior as a consequence of using our system, of viewing conventional versions of our programs over cable, or of no-treatment involvement. This project is raising important issues for interactive telecommunications generally: What organizational structures and human skills are necessary to develop software that meets user needs for computer-based telecommunication services? What costs are incurred in the production of computer-based telecommunication programming, and how can these costs be amortized? What criteria of service benefits are appropriate for judging the merits of computer-based telecommunication, compared to less exotic information systems? What other applications are feasible of the computer algorithm used by the Michigan project--one developed by colleagues at Michigan State University? I will focus on these issues by showing a portion of our programming and by discussing how they are exemplified in our project.

The Effectiveness, Acceptability, and Economics of New Interactive Telecommunication Systems. MARTIN ELTON (Communications Studies and Planning Ltd., London, and Alternate Media Ctr., N.Y. Univ. Sch. of the Arts, New York)

The presentation will summarize the results of research on audio, video, and computer conferencing which has sought to answer the questions how effective, how acceptable, and how economical can they be in relation to pre-existing modes of communication. This will draw mainly on research conducted over the last 8 years in the United States, Canada, and Britain. Typically such research has been based on a concept of teleconferencing limited to its role as a substitute for in-person meetings and conventional print media. Increasingly experience with operational systems is confirming that a broader concept is essential. This issue too will be discussed. Particular attention will be paid to the evaluation of new systems within the context provided by an electronic journal incorporating computer graphics.

Communications for Survival. PETER C. GOLDMARK (Goldmark Communications Corp., Stamford, Conn.)

This presentation will deal with a 5-year government-funded study that established some basic considerations concerning depletion of our major national resources: human, the earth including energy, and the environment. Universal information and learning opportunities concerning changes needed in our way of life to match the rapidly changing world is a basic element that education now has to supply. Educational institutions and technology-based development can offer a new nationwide network of adult education accessible to everyone at low cost and high quality and flexibility. It is needed because the traditional ways of educating people no longer meet the need for quick and appropriate reaction to national problems. The new learning format, the technology, and the institutional and government activities involved in this project will be described along with the genesis of our efforts in this area of audiovisual communication. We did not develop the technology for the sake of it, but rather to satisfy certain important teaching and learning requirements, in other words, to fill real needs.

Audiovisual Teleconferencing: Computer Vocal Commands and Response; and Computer-to-Computer Communication. S. JOSEPH CAMPANELLA (Comsat Labs., Clarksburg, Md.)

This paper will cover a number of topics that apply to a future reactive communication system. The first topic of the title relates to the various ways of implementing audiovisual conferencing and the human reaction to them. The second topic relates to computers implemented to recognize vocal commands and to emit vocal responses. The third topic relates to the way to interchange computer programs and data bases at high speed on a worldwide basis. The paper will be accompanied by a videotaped presentation of research at Comsat Laboratories on these and related topics. In addition to work at Comsat, work by others, such as the Japanese, will be described. The paper and videotape presentation will consider the feasibility of a future audiovisual communication network which would evolve from present communication systems and incorporate much of the present print media. This TV of tomorrow could serve as a research journal among its many roles, both for the submission of information and the retrieval of information. The communication network would allow the journal role to easily be supplemented by direct communications such as teleconferencing.

4. ENGINEERING AND TECHNOLOGY

Macroengineering Projects: The Infrastructure of Tomorrow

Arranged by FRANK P. DAVIDSON (MIT), LAWRENCE J. GIACOLETTO (Michigan State Univ.) and ROBERT SALKELD (System Development Corporation, Malibu, CA)

Mon., 13 Feb. / Sheraton-Park / Arlington-Alexandria

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Historical Perspectives on Macro-Engineering Projects. Eugene S. Ferguson (University of Delaware and The Hagley Museum).

When 20th century engineers learn the details of an early large-scale engineering project, they are invariably surprised at the size and complexity of the work and the sophisticated knowledge that was exhibited by the builders. Their surprise turns to amazement when they begin to realize how very numerous and how extensive, over the last 500 years, the large-scale projects have been. A sampling of early works will be described briefly, and illustrated (with slides) to show the characteristics common to such projects: 1, macro-engineering works exhibit monumental and belligerent qualities; they announce to the ages their successful conquest and subjugation of nature; 2, an enthusiastic promoter is at the heart of the project, either the person whose ideas the project is to embody or his immediate disciple; 3, the promoter has convinced a patron that the project is worthy of support despite its uneconomic nature. Economic arguments are frequently used, but nobody believes them; 4, to be successful, the project has had to neglect totally any probable effects other than those encompassed by its central purpose.

Macro-engineering and the Environment. Howard Margolis (MIT), Frank Laird (MIT).

Our interest is in projects which as single entities have significant potential for major international environmental impact. In general, such projects will be of extraordinary scale. An example is the Soviet plan for reversing the flow of Siberian rivers. But one can imagine projects meeting our criterion which are not "macro" in the sense of the symposium, such as genetic engineering of new life forms. We are primarily interested in the politics of such projects. Our paper comments on some reasons for studying macroengineering projects as a class, and gives some results of our preliminary inquiry. The work was undertaken in connection with the MIT Program on International Environmental Issues.

The United Nations' Model Neighborhood in Peru --Prototype for Tomorrow? Peter Land (School of Architecture, Illinois Institute of Technology).

There will be a full description (with slides) of the Experimental Housing Project recently completed in Lima. The project was sponsored by the United Nations in order to develop and demonstrate new techniques and designs for economical houses and their planning, for low-income sectors of the urban population. The technologies and design concepts have international ramifications. Design teams from fourteen countries participated in this important and unique international enterprise.

Planning and Conduct of Macro-Engineering.

RICHARD GODWIN (Bechtel, Inc.) and KENNETH DAVIS (Bechtel Power Corp.)

The principal ingredient of success in large-scale engineering projects relates to the detailed planning and scheduling of the different elements involved. Major macro-projects turn out to be international in content; this adds a new dimension to the engineer's outlook. Sensitivity to environmental and social effects is essential, in all parts of the world. Macro-projects typically involve governmental participation as well as the resources of the worldwide financial community. Hitherto sharp distinctions between engineering, legal and economic areas are disappearing with the emergence of the new profession of macro-project management.

The Finance of Macro-Projects.

Wallace O. Sellers (Merrill Lynch, Pierce, Fenner & Smith).

A review of the factors considered by underwriters and other financial houses before making commitments. Examples of very large engineering projects where the private sector played a leading role in marshalling the needed funds. Requirements of security and the history of guarantee arrangements, leases, through-put agreements and other devices. Varying forms of public sector participation. The influence of intergovernmental financial institutions such as the World Bank. The importance of competent inter-disciplinary feasibility studies. Capital markets and the future of macro-engineering.

Macro-Systems for the Oceans.

J. VINCENT HARRINGTON (Electric Boat Company, General Dynamics Corporation)

A brief historical summary of the expanding uses of the ocean, starting with transportation and fishing and ending with modern developments in ocean usage, is given. Modern usages of the ocean are reviewed and near term expansion of these usages is then examined. Methods and equipment for carrying out work in the ocean at the present time, covering the many surface platforms and many subsea tools, are next examined. Extensive support is required for seagoing projects. Activities such as logistic support, including the provisioning and staffing of offshore operations, the maintenance of existing equipment and the procurement and construction of new equipment, are covered. Emphasis is given to the requirements for training both technician and engineering personnel to insure the adequacy of staff needed to carry out the work. There are increasing regulatory standards which must be met in conducting offshore projects. These standards are found in international treaties, in national and state rules and regulations, and by persuasive impositions by many interested environmental groups. The total regulatory requirements, while often conflicting and unclear, impose requirements that must be considered in the planning of major seagoing activities. The paper is intended as an overview of planning requirements for seagoing activities.

Trans-Planetary Subway Systems: A Burgeoning Capability.

ROBERT M. SALTER (The Rand Corporation)

Reviewed are underground transportation systems of tunnels containing evacuated tubes and guideways for electromagnetically projecting and suspending ultra-high-speed vehicles traveling at thousands of miles per hour. Prevention of high lateral accelerations at these speeds necessitates control of minute excursions from a predetermined trajectory through use of microprocessor systems that can also sense and correct against transient earth movements. Benefits of single modal configurations with local conventional subways are discussed, plus prospects for co-location of 100 mph railway car container networks and of transplanetary utility distribution systems including laser-fibreoptic, and superconducting-electrical-power cabling. Tunnels, preferably in competent rock from several hundred feet to a mile underground, may benefit from many new excavation technologies. Under-ocean floor approaches may permit intercontinental links. Quiet, pollution-free, highly-efficient and low-cost operation is predicted, employing only a few percent of the energy needed for equivalent aircraft travel.

Solar Power Satellites - The Promise and the Challenges

Dr. Peter E. Glaser (Arthur D. Little, Inc.)

The methods for large-scale conversion of solar energy are reviewed and the rationale for solar energy conversion in geosynchronous orbit of the Earth to generate baseload power is provided. The evolution of the concept of the solar power satellite (SPS) is presented and the technology options for converting solar energy in space and transmitting microwave power to Earth are summarized. Photovoltaic and solar thermal conversion methods are examined and salient characteristics are provided. The details of microwave power generation, transmission and conversion to DC at a receiving antenna on Earth and beam control methods are discussed. The requirements for a space transportation system, orbital construction and assembly, maintenance and operations, are reviewed and the role of man to accomplish these tasks is outlined. The environmental impacts of SPS operations such as stratospheric pollution by space vehicle exhaust products and of the microwave beam, including atmospheric attenuation and scattering, ionospheric effects, radio frequency interference, and microwave biological effects are discussed. Development programs for the SPS are outlined; critical technology areas are listed and economic and social issues are considered. The potential contributions of the SPS to meet future energy demands and its implications for the industrial uses of space are projected.

Resource Potentials of Asteroid Capture.

BRIAN O'LEARY (Princeton University).

Mass drivers can be designed to move Earth-approaching (Apollo and Amor) asteroids at opportunities of low velocity increment to the vicinity of the Earth. This class of asteroids are competetive candidates as raw material for space manufacturing because of the low energy of transfer of these bodies to high Earth orbit; the likely availability of carbon, water, nitrogen and free metals which appear to be scarce on the Moon; the increasing rate of discovery of mission candidates; and for various logistical reasons.

A TVA for Space? Some Practicalities for Near Term Decisions

Philomena Grodzka (Lockhead Missles and Space Co., Huntsville, Ala).

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Hypergraphics: Visualizing Complex Relationships in Art, Science, and Technology

Arranged by DAVID W. BRISSON (Rhode Island School of Design)

Tues., 14 Feb. / Sheraton-Park / South Cotillion

3:00 p.m.-6:00 p.m.

Geometry in Applied Science and Engineering

STEVE M. SLABY (Princeton University).

Geometry, in the form of descriptive, visual and spatial relations has had a long historic development ranging from the primitive drawing of the caveman to the sophisticated, intricate, and complex multi-view and multi-dimensional drawings of today. In man's struggle to understand the universe he has not only required the development of abstractions of physical nature, but equally, graphic pictures which reflect and represent nature. Art, science, and engineering are based on the geometries of nature which take shape in drawings, models, paintings, and mathematics. The tranformation of abstractions of nature to appli-

cations in science and technology is only possible through the medium of applied geometry. This paper develops the above points.

Computer Animated Four-Dimensional Geometry

THOMAS F. BANCHOFF (Brown University), CHARLES M. STRAUSS (Brown University)

We can study geometric objects in 4-dimensional space by projecting them in real time to the screen of a computer graphics terminal. By choosing a rotation matrix, we produce a one-parameter family of images which we photograph by animation techniques, using fitters to produce different colors. We represent other deformations by linear interpolation, and we display the level sets of functions defined on surfaces. We present films which use these techniques to investigate the following objects in 4-dimensional space. The 4-dimensional cube with vertices (±1, ±1, ±1, ±1), with orthographic projections, central projections, and slicing by families of hyperplanes. Complex functions graphs $w = z^2$ and then $w = e^z$. The flat torus (sinθ, sinϕ, cosϕ) projected stereographically from the 3-sphere to 3-space. The Veronese embedding of the real projective $(\frac{1}{\sqrt{2}}(x^2 - y^2), \sqrt{2}xy, \sqrt{2}yz, \sqrt{2}zx)$ defined on the hemisphere $x^2 + y^2 + z^2 = 1, v \leq 0$.

Visual Comprehension of N Dimensions.

DAVID W. BRISSON (Rhode Island School of Design).

This presentation will demonstrate the use of the hyper-stereogram and its generalisation as a direct method for the visual comprehension of hyperfigures in hyperspace. A number of the more common hyperfigures of four dimensions will be so presented, as well as several of five dimensions. The method allows an extension to the representaion of the non-Euclidean geometries and a basic method of representing the Elliptic hyperspace will be demonstrated as well as a method of representing Hyperbolic space utilizing an extension of the concept of the Complex plane to N dimensions. This incidently allows a comprehensible visual method of representing the function of a Complex variable. Some of the figures and hyperfigures that will be thus represented are: the hypercube, hypersphere, surface of double-revolution, double prisms, hypernetworks, 5-spherical hypercube, Clifford's surface, a sphere with an imaginary radius and the Hyperbolic plane, the Klein bottle etc.

Hypergraphics in Scientific Thought.

Gregg Edwards (National Science Foundation).

This paper reviews some recent advances in (computer) graphics technology, perceptual psychology, social "info-networking", and modern geometry which might contribute to improved "reading, riting, rithmatic" in science and technology. Fast, cheap, capatious computers, memories, and sophisticated software now allow highly interactive graphical displays which approach personalized movies that could respond to eye or EEG cues. Human factors relating the rates and modes of static and dynamic representations offer possible generalizations of the ideas and uses of dimension, hierarchy, and category: interpretation and authoring of graphical content is helped by having a large repertoire of generally recognized forms; dimensions of generalizations ("latencies") can be represented to establish/adumbrate a context; characterization of the varieties of geometric transformations and topological connections offer cues to possible "visual grammers" which might simplify usage.

Thus scientific thought might evolve a new mode of recording data and presenting theoretical significances. Because of the potential increases in speed and complexity, this mode ultimately could be as significant an advance over writing as writing was over the transmission of culture by oral love.

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Corrosion: The Silent Scourge

Arranged by WILLIAM R. PRINDLE (NAS)

Tues., 14 Feb. / Sheraton-Park / Richmond

3:00 p.m.-6:00 p.m.

Societal Consequences of Corrosion.

R. W. STAEHLE (The Ohio State University)

The societal consequences of corrosion are portrayed in the framework of needs of the people, facilitators, materials, environments, and micro processes by which materials degrade considering corrosion starts from the vantage that all materials are unstable. This idea then is interpreted with respect to the needs of people: food, clothing, housing, personal growth, transportation, communication, and recreation. The instability of materials is also interpreted as it effects the facilitators of these needs: energy, materials, policial stability, capital equipment, government, educational institutions. Materials to service these needs and facilitators are metals, polymers, ceramics, aggregates, wood, paper, natural fibers, and artifical fibers. Each of these is subject to degradation processes many of which are similar to atomistic levels. The materials, to be useful, must survive in the following environments in their various states of impurity, concentration, oscillations, and flow: atmospheric, water, thermal, processing (food, chemicals, cleaning, operation, and body), radiation (ultraviolet, gamma, neutrons, electrons, alpha), fields (electric, magnetic, gravity), and stress. Essential concepts of these matrices will be identified in this address.

Museum Research in Corroded Artifacts.

MARTHA GOODWAY (Smithsonian Institution).

The loss or disfigurement of archaeological and historical artifacts through corrosion poses serious problems of interpretation in the history of technology, culture, economics and art. Pollution has already disfigured the horses of St. Mark's, and threatens to destroy them. The iron currency bars of prehistoric Britain have rusted at different rates, making assignment of their relative values problematic. Well-fired ceramics are more lasting than metals, confusing the site statistics for the archaeologist. Whole classes of museum art objects, such as Chinese bronze ritual vessels or Renaissance statuary, are displayed with a corroded surface, whether as an intentional patina or as an aesthetically pleasing accident of nature. The museum metallurgist in studying the remains of our material heritage must rely on the occasional positive effects of corrosion in preserving form, structure, and associated material. Technical examination of museum objects has revealed patinas which have proved protective for centuries, as in the famous "mirror black" of the Chinese, and corrosion products new to mineralogy, such as romarchite and hydroromarchite, found on pannikins recovered from the Winnipeg River, and chalconatronite, discovered on a coptic censer in the Freer Gallery of Art. Illustrated.

Economic Effects of Corrosion.

ELIO PASSAGLIA, (National Bureau of Standards).

Corrosion causes the uses of durable goods to incur costs for their maintenance and replacement. When best practice corrosion-control technology is used, these costs are unavoidable, and with constant economic factors such as discount rates and tax structures, can only be reduced by technological development. When best practice technology is used, a portion of these costs is avoidable. An estimate of these costs for all sectors of the U.S. economy will be presented. Data will be given for the producing sectors as well as for final demand. The costs will be given for corrosion maintenance and control, for equipment replacement when such replacement is because of corrosion, and for redundant capital equipment when such redundancy is required because of corrosion.

Current Directions in Corrosion Research. JEROME KRUGER (National Bureau of Standards).

Today's corrosion research is concentrating on studying corrosion processes by using approaches that focus on relevant environments, films, alloys, and basic processes. Among the examples of work employing such a focus are the following:

1) Relevant environments: Studies are carried out in environments that more closely correspond to the environment that develops in cracks, pits, and crevices.

2) Relevant films: The role of noncrystalline films is being explored.

3) Relevant alloys: Studies employing alloys that simulate phases or components are used to study localized effects.

4) Relevant basic processes: The role played by the interplay of breakdown and repassivation processes is being explored for pitting, stress corrosion, and other forms of localized attack.

Aiding in these studies is the application of such modern surface analytical techniques as auger spectroscopy, ESCA, SIMS, Mossbauer spectroscopy, and others.

Problems in Transfer of Corrosion Technology. M. BRIAN IVES (McMaster University)

There is no doubt that corrosion represents, as it has done for so many years, a major problem for the utilization of metals and alloys in our technological society. Adequate awareness of corrosion and its potential effects exists in only a few specialized disciplines: For most of us, corrosion is an unfortunate fact of life. But the financial consequences of even the simplest precautions of corrosion protection in all engineering design could be significant. While by no means all corrosion phenomena are understood, corrosion research has resulted in the development of methods and designs for reasonably effective control of corrosion in most engineering situations. All practicing scientists and engineers should strive to become familiar with the significant conclusions of recent corrosion research. In this presentation, some means to achieve such familiarity are suggested, drawing on the author's experiences of some years of active corrosion research along with impressions of specific industrial corrosion problems.

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Appropriate Technology: Panacea for Developing Nations?

Arranged by KATRINA L. EADIE and DAVID G. CARTANO (Univ. of Miami)

Wed., 15 Feb. / Sheraton-Park / Richmond

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Technology in Transition: Dilemma of a Mexican Community. CYNTHIA HEWETT DE ALCANTARA (Ford Fellow, Mexico City).

A.T.: The Challenge to U.S. Agricultural Colleges. MILTON MORRIS (University of Florida).

A.T.: Brake or Catalyst for Development? A. EUGENE HAVENS (University of Wisconsin, Madison).

Can Developing Nations Afford A.T.? WITOLD RYBCZYNSKI (McGill University, Montreal, Canada).

The Organizational Response to the Adoption of A.T. by Peasants. MARTIN PIÑEIRO (Instituto Interamericano de Ciencias Agrícolas, Bogotá, Colombia).

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Effects of Changing Social Priorities on Engineering and Technology in the United States and Abroad

Arranged by GEORGE BUGLIARELLO and A. GEORGE SCHILLINGER (Polytechnic Institute of New York)

Thurs., 16 Feb. / Sheraton-Park / Richmond

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

How Social Change is Changing Engineering. LEWIS M. BRANSCOMB (IBM Corp., Armonk, N.Y.).

Changes in public expectations that impact technology and the practice of engineering include: 1) the assumption that society will protect the individual against unanticipated loss; 2) a change in values in which services become more important as an element of life quality than material goods themselves; 3) a world in which the secondary effects of economic activity, in the aggregate, often exceed in importance the primary effects; 4) a tendency for the technologies of greatest concern to the public to become the responsibility of public institutions -- health, education, public safety and transportation -- and; 5) a determination that development and production technologies will respond to the desire for greater satisfaction in the working experience. The consequences of these changes to engineering include greater emphasis on: 1) cradle to grave design that increases maintainability; 2) design for human shortcomings in maintenance and use; 3) improved engineering support for the delivery of services, such as health and education; 4) the difficulty of innovation and market entry in the area of public technologies; 5) the anticipation of secondary consequences of new technologies, including models for future events, anticipating socio-political factors, design and testing for events of low likelihood and quantitative measurements after market introduction and, finally: 6) design of processors for workplace satisfaction -- automation to increase human control, not decrease it.

Social Priorities, Technology and the American Consumer. WILLIAM F. MAY (American Can Company)

Since World War II our Western society has passed the point where the technical problem of making and selling things is of fundamental importance. We know pretty well how to produce metals, plastics, power, food and so on . . . and we also know pretty well how they can be applied to man's benefit. We know we can increase production to any level we desire by the application of enough investment in the means of production, and we can increase the scope and utility of our products through research and development. What we do not yet know is how to create a social, political and economic environment in which all the people have the power to purchase our products at a price that repays us for having produced them in the first place. Thus, the business of business would appear no longer merely to be productive -- but to improve the very nature of the market itself. The new role of business, then, is to help create a kind of society that can participate in and enjoy the new technological world which science and industry helped create.

The University Role in Exploring Societal Choices of Technology. WILLIAM LINVILL (Stanford University)

Many new technological options are becoming available to society. To assess the impact of possible new technologies, to help in their selection, and to adapt them both technically and socially in the operational patterns, calls for an integrated combination of skills and insights from: technology and engineering, economics and management, law and politics. The analytical and deductive skills of modeling and optimization must be combined with the artistic and operational skills of decision-making and policy formulation. Experiments must be performed, effects must be assessed, modifications must be made, operations must be perfected -- all in the societal setting. All these formative experimental, and adaptive projects can be initiated and perfected in the pliable and exploratory interface between the academic and the operational world. By having graduate students moving between academic programs on campus, practical political operations in the government, and developmental operations in industry, we can perform the societal explorations needed to select, adapt, and perfect the technologies to serve new functions. An experimental graduate program of this sort, with interns in government and in industry, has been operating at Stanford University for a few years. It appears to provide the exploratory setting needed to introduce and adapt new technology, and at the same time to provide a means to develop the artistic skills of technology policy-making in a practical setting.

The Political Limitations in Steering Technology. EDWARD WENK, JR. (University of Washington, Seattle).

Opportunities for Technology in a Changing World. N. BRUCE HANNAY (Bell Laboratories).

Increasingly, the international aspects of technology have become of importance to the United States. There are many facets to this. The interdependence of nations in such areas as energy and materials resources emphasizes the common need for useful technology. Some technologies by their very nature transcend national boundaries -- for example, those relating to space, weather and the oceans. Others have a more particular applicability that stems from a country's unique state of development and its resources, natural, human and financial. Technology transfer has assumed international economic and political importance. The role of public and private institutions in the flow and utilization of technology is being examined, questioned, and reformulated. The international development of technology is producing changes in our trade patterns and position, and through this in our domestic economy; correspondingly, the U.S. domestic factors affect international development. Technology has become recognized as an element in U.S. diplomacy. International cooperation in technology is being proposed as a needed extension of the cooperation in science that has existed for many years. Given these changes in the real and the perceived role of technology in international relationships, scientists, engineers and technologists are faced with challenges and opportunities not only to respond with technologies needed by society, but also to exert leadership in beneficially relating our technological potential to the shaping of national policies and actions.

Do Global Technologies Require Global Politics? HARLAN CLEVELAND (Aspen Institute for Humanistic Studies)

The international organizations designed a generation ago to govern the cooperation of nations, no longer seem to work as well. The static charters and status quo compacts do not provide for the prime issues in "harmonizing the action of nations": managing interdependence, meeting basic human needs and promoting peaceful change. Yet, new technologies and weapons make nearly every human concern more international than it was before, and concerned nations have a long agenda of creative effort ahead. Among the items for action are: the creation of a food reserve and energy supplies, lowering of fertility rates, protection of the global environment, management of the oceans and their resources, and control of conflict in a world of proliferating weapons. Most tasks on this incomplete agenda involve new technologies, some on a global scale. Moreover, a growing number of operational functions, by necessity, transcend national dimensions, and may be manageable only in a global regime: for example, weather modification, satellite communications, pollution monitoring, and remote sensing from space vehicles, all require broad international agreements and management. One must ask what new complex of principles, strategies and institutional changes are needed instead of a traditional over-arching world organization to make the system work?

Appropriate Technologies for Developing Countries: Criteria and Their Application. RICHARD S. ECKAUS (Massachusetts Institute of Technology).

The designation of a technology as, "appropriate," implies a criterion by which technologies are judged. Yet, surprisingly little attention has been paid to formulating such a criterion. The implicit criteria which have been used include: (1) output maximization or cost minimization; (2) employment maximization; (3) maximization of the availability of consumption goods; (4) redistribution of income and wealth; (5) reduction of balance of payments deficits; (6) regional development; (7) promotion of political development; (8) improvement in the quality of life for the population as a whole. The choice of a particular technology is not necessarily the most effective means of achieving these aspirations. In addition, the criteria are to some extent competing rather than complementary. Moreover, the debate often assumes that many of the continuing difficulties of economic development are primarily technological in nature. For example, the problems of growing open employment and of capital scarcity have been ascribed to a mistaken emphasis on particular types of "modern," "capital-intensive" technologies. Yet, the diagnosis may be wrong. The problems are more often in the economic policies which have followed. While technological research is worth encouraging, the proximate remedy is not in the search for more appropriate technologies but in the reform of economic policy. The formation of appropriate technology research centers, by focussing on technology itself may well miss the major sources of solutions to development problems.

Technology and International Development: Is There a Role for U.S. Engineering Schools? ROBERT P. MORGAN (Washington University).

The purpose of this paper is to examine the role of U.S. engineering schools in assisting developing countries to improve their indigenous base for using science and technology for development. Among the topics to be considered are international cooperative R & D activity, courses and curricula geared towards development problems and issues, international technology policy research, and the role of engineering schools in generation and dissemination of appropriate technology. The effects of changing social and governmental priorities on future engineering school involvement in international programs will be discussed.

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The Role of Technology in Changing the International Economic Order

Arranged by JACK BARANSON (Developing World Industry and Technology, Washington, DC)

Fri., 17 Feb. / Sheraton-Park / Richmond

9:00 a.m.-12:00 m.

Changes in the World Economy Affecting International Transfers of Industrial Technology. JACK BARANSON (Developing World Industry and Technology)

The paper will provide an overview of changes that have occurred in the world economy over the past twenty-five years that have influenced the patterns and modes of international transfers of industrial technology. Included in these changes are the economic and commercial objectives and strategies of both purchasers and suppliers of technology, and their respective governments, in various parts of the world. These changes will be examined in terms of three distinct sets involving technology transfer arrangements between developing world and industrialized nations (North-South), industrialized nations and communist countries (East-West), and among industrialized nations (West-West). The latter will include the role of technology acquisition in Japan's industrial development and expansion into world markets. The implications of these changes for technological interchange in the foreseeable future and its relationship to world trade and development also will be examined.

Corporate Response in the Automotive Industry. CHRISTIAN N. KRISTOFF (General Motors Corporation)

International technology transfers over the past 25 years in the automotive industry can be viewed as a continuum with evolutionary growth in scope and degree. While the transfer process involving automotive assembly was well established prior to World War II, it was not until the 1950's that significant transfer took place to help rebuild war torn economics as well as to respond to changing consumer needs, altered manufacturing and sourcing strategies, national goals for industrialization and other direct or indirect factors. The transfer process during this period covered a wide spectrum from complete manufacturing plants and processes to transfer of designs, know-how and people. Implicit in this transfer process was the need for modification and adaptation to meet local needs and conditions. As the automotive industry became more firmly established in these developed countries, more emphasis was given to requirements of the developing countries where different strategies and processes were needed to implement the technology transfer process. Currently, the automotive industry utilizes several adaptations of technology transfer in the employment of its assets. In the more immediate time frame, other strategies and adaptations are envisaged. This paper will trace the automotive industry's response to technology transfer against a background of change in the international economic order, review the evolutionary changes the process has undergone; assess the current situation and explore likely scenarios in the more immediate time frame.

Corporate Response in the Energy Field. EDWARD J. GORNOWSKI (Exxon Research and Engineering Co.)

Technology has always been a prime element of international energy relationships. "Technology" as used here is intended to connote not only applied science and engineering capability but also logistical "know-how" and capacity to create an operational infrastructure. Our energy trading partners now place greater value than ever on "technology" thus broadly defined. Furthermore, they desire the technology to be applied not only to specific projects but also to be transferred to the host nationals on a continuing basis. To compete fairly and effectively for a continuing share of world energy resources and to recover and utilize these resources in the most efficient, environmentally sound manner, we will have to continue to generate new, pertinent cost-effective technology. This is an area in which the American private sector has achieved an unsurpassed record. It will continue to do so given a reasonably agreeable domestic business climate. It would, indeed, be sadly ironic if ill-conceived domestic policies were to severely restrict the ability of American companies to generate and use new technology. This, in turn, would adversely affect our ability to obtain, on an equitable basis, the reasonable share of overseas energy resources that has become so important to our economic well-being and freedom.

Corporate Response in the Electronics and Communications Industries. JOHN B. ARNOLD (General Telephone and Electronics).

This paper will address the questions of response by GTE and other major electronics corporations to new sets of challenging conditions in the world market place. It will consider alternative approaches to the issues of local supply in the context of changing international economic environments. The company's recent experiences in developing countries, specifically Algeria, will be described as case studies.

Transfers of Industrial Technology Within the Atlantic Community: Issues and Prospects. JOHN H. HOAGLAND (Hoagland, MacLachlan & Co., Inc.)

In the second half of the 1960s, the issue of the "Technology Gap" stimulated the formation of new industrial technology policies, throughout Western Europe, in the fields of nuclear energy, electronics and data processing, aeronautics, and automotive equipment. These policies, and their implementation by national and supranational agencies, have produced some unexpected results in the 1970s, especially in terms of technological and economic relationships with the United States. The paper compares the recent experience of two industries: first, the automotive industry, in which there is approximate technological parity between Western Europe and the United States; and second, the aeronautical industry, in which there are some critical technological imbalances which favor the United States. In both cases, the critical areas of technology (e.g. propulsion, electronics, structures and materials) are compared; current European R&D and industrial investment policies (both national and collaborative) are identified; technology transfer issues of the present and early future are assessed; and international policy implications are discussed, both in economic and technological terms. Some conclusions are offered about the most constructive use of industrial technology transfers in the trans-Atlantic relationship.

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Appropriate Technology in the Developed Countries: The Macro and Micro Sides of It

Arranged by ROBERT M. PIERSON (Goodyear Tire and Rubber Co., Akron, OH) and ALLEN JEDLICKA (Univ. of Northern Iowa)

Fri., 17 Feb. / Sheraton-Park / Richmond

3:00 p.m.-6:00 p.m.

Appropriate Technology: The Changing Technological Order of the Developed Nations. ALLEN JEDLICKA and ROBERT M. PIERSON

Technology that Helps the Environment. JOHN F. SEIBERLING, JR. (Member, US House of Representatives, D-Ohio).

Structural Basis to Begin a Dialogue on Appropriate Technology. BETH HAGENS (Dir., Midwest Energy Alternatives, Governor's State Univ., Park Forest South, Ill.).

Engineering Farm Equipment for World-Wide Markets. GORDON H. MILLAR (Vice Pres., Eng., Deere and Co., Moline, Ill.).

Appropriate Technology and Low-Income People. JAMES SCHMIDT (Dir., Natl. Ctr. for Appropriate Technol., Butte, Mont.).

Industrial, Agricultural, and Pharmaceutical Chemicals in Developed and Developing Economies. WILLIAM R. NUMMY (Dir., Pharma. Res. and Devel., Dow Chemical Co., Midland, Mich.)

5. PHYSICAL SCIENCES

Gravitational Physics -- A New Window for Exploration

Arranged by WILLIAM O. HAMILTON (Univ. of Rochester)

Mon., 13 Feb. / Sheraton-Park / Richmond

9:00 a.m.-12:00 m.

Gravitational-Wave Astronomy. KIP S. THORNE (California Institute of Technology).*

Einstein's theory of gravity predicts that gravitational waves must exist. The detection of such waves, and an experimental study of their properties, will permit clean experimental tests of Einstein's theory. More importantly, gravitational waves are a promising new window into the Universe. They should be produced prolifically in the

birth throes of neutron stars and black holes; and perhaps also in gigantic explosions in the nuclei of galaxies and quasars, in the quiescent evolution of young pulsars, in the starquakes of old pulsars, and elsewhere.
Gravitational waves are man's most promising tool for future observational studies of some of these phenomena.

* Supported in part by the National Science Foundation [AST 76-80801] and by the National Aeronautics and Space Administration [NGR 05-002-256].

Gravitational Wave Experiments. WILLIAM O. HAMILTON (Louisiana State University+ and University of Rochester).

Experiments are underway world-wide to look for the gravitational wave events predicted by relativity theory and by astrophysical calculations. The experiments are made difficult by the extreme weakness of the gravitational interaction. This results in gravitational waves causing motions in the antennae less than the mean square thermal displacement. Attempts to measure this displacement can sometimes influence the antenna as much as the gravitational wave. Techniques to extend the sensitivity include construction of cryogenic antennae of large mass, dielectric antennae with Q's of 10^9 and greater and free masses with laser interferometer detectors. The current experimental picture will be surveyed with special emphasis devoted to the cryogenic detectors.

+Permanent address

Solar System Experiments to Probe the Gravitational Interaction. IRWIN I. SHAPIRO (Massachusetts Institute of Technology).

Using radio systems aboard spacecraft, as well as powerful earth-based radar and laser systems, scientists are able to study many post-Newtonian effects of the gravitational interaction. A review will be given of the present status of experiments to test the principle of equivalence for massive bodies, the constancy of the gravitational interaction, and the predicted geodesic trajectories of particles and light rays, with special emphasis placed on the results of the Viking Relativity Experiment. Prospects for the dramatic improvements in the tests needed to allow the detection of post-post-Newtonian relativistic effects will also be described.

Atomic Clock Measurements of the Effect of Gravity on Time Using Aircraft and Laser Light Pulses for Time Comparison. C.O. ALLEY (University of Maryland), L.S. CUTLER (Hewlett-Packard Co.), R.A. REISSE, R.E. WILLIAMS, J.D. RAYNER, C.A. STEGGERDA, J. MULLENDORE, S. DAVIS, L. SMALL, and B. DUVALL (all University of Maryland).*

Careful packaging of modern cesium beam atomic clocks (modified Hewlett-Packard Type 5061A) to shield them from vibrations, shock, and changes in temperature, pressure, and magnetic fields can produce typical stabilities over 15 hours of (2 or 3)x10^{-14} even in an aircraft environment. Five independent flights of this duration in a circling, radar-tracked, Navy aircraft carrying a set of three clocks at an average altitude of 10 km allowed a measurement of the effect of the gravitational potential difference on time with respect to a similar set of ground clocks with an accuracy of 1.6%. The developing time difference during flights was measured with 0.1 nanosecond pulses of laser light according to the original prescription of Einstein for comparison of clocks at a distance. In separate experiments near the time of the summer solstice, a set of clocks was flown twice in an Air Force aircraft from Washington, D.C. to Christchurch, New Zealand and back. Direct comparison with the ground set of clocks verified that the difference in the gravitational potential of the sun does not affect clocks differently on the freely falling earth.

*Supported by the U.S. Navy (Naval Observatory; Office of Naval Research; Materiel Command; Patuxent Air Test Center) and by the U.S. Air Force (Office of Scientific Research; Rome Air Development Center; 4950th Test Wing).

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Progress in X-ray Astronomy -- First Results from HEAO-1

Arranged by HERBERT GURSKY (Smithsonian Astrophysical Observatory, Cambridge, MA)

Mon., 13 Feb. / Sheraton-Park / Richmond

3:00 p.m.-6:00 p.m.

A Deep Survey of the X-ray Sky. HERBERT FRIEDMAN (Naval Research Laboratory).

HEAO-1 was launched on August 12, 1977. It is equipped with four instruments designed to map the energy range from 150 eV to 10 MeV, to measure spectra with sufficient resolution to identify line radiation and to position strong sources with an accuracy of about 5 arc seconds. It is expected that a six-months' survey of the sky will expand the catalogue of X-ray sources by an order of magnitude. An interim progress report on the survey will be presented.

The Diffuse Component of the Cosmic X-radiation. ELIHU BOLDT (NASA/Goddard Space Flight Center).

The X-ray sky is dominated by an apparently diffuse flux, the origins of which are addressed by the HEAO A-2 experiment. By a systematic survey of the entire sky over a wide spectral band (0.15-60 keV), galactic and extragalactic components may be separated. For the galaxy, this involves mapping relatively intense soft X-rays from a hot gas that fills much of the interstellar medium as well as a considerably weaker flux of hard X-rays arising from non-thermal processes. Small deviations from isotropy in the extragalactic hard X-ray background are being studied for fluctuations characteristic of the contribution of distant unresolved discrete sources as well as smooth variations indicative of our galaxy's motion relative to the proper frame of this background. The spectrum measured for the extragalactic hard X-ray background is examined in terms of the spectra measured for discrete extragalactic objects and the contribution of a possible intergalactic hot plasma.

Optical and Radio Counterparts of X-ray Sources. HERBERT GURSKY (Center for Astrophysics, Smithsonian Astrophysical Observatory, Harvard College Observatory).

The ability to locate x-ray sources on the sky with high angular precision has been fundamental to progress in x-ray astronomy. Much of what we know in the field has emerged from these measurements since they allow finding the radio and optical counterparts. This in turn allows for a much broader range of information on the objects and a tie to well-developed theories. The scanning modulation collimator on HEAO-1, a joint MIT-Smithsonian project, allows determining the source positions to a limiting precision of 5". Preliminary results from this experiment will be presented as well as a general overview of the correspondence between the x-ray and the optical-radio sky as we know it.

A High-Energy Survey of the X-Ray Sky. JAMES L. MATTESON LAURENCE E. PETERSON (UCSD), WALTER H.G. LEWIN (MIT), JEFFREY HOFFMAN (MIT).

The UCSD/MIT Experiment of HEAO-1 uses an array of actively shielded scintillation counters to detect X-and gamma-rays in the 10 keV to 10 MeV range. Fields of view vary from 1.6° x 23° FWHM at low energies to 40° at high energies. The total sensitive area is ~ 500 cm^2. The instrument's combination of a wide field of view and good angular resolution in the 10-200 keV range allows discrete source variability to be studied continuously for periods $\gtrsim$ 40 days. Scientific objectives of the experiment include a complete survey of the sky for hard X-ray emission from discrete sources, the search for cosmic gamma-ray spectral lines, the search for X-and gamma-ray pulsars and the measurement of the spectrum and isotropy of the cosmic background. Early results are expected to include the high energy behavior of X-ray novae, improved measurements of hard X-ray "tails" of thermal X-ray sources, resolution of the galactic center sources and extension of their X-ray spectra to ~200 keV and a map of the galactic plane in the emission of gamma-ray spectral lines.

The Relation of the HEO-1 X-Ray Results to Fundamental Problems in Astronomy. WALLACE L. W. SARGENT (Hale Observatories and California Institute of Technology)

The bearing of the new results from HEO-1 on several astronomical problems of topical interest will be discussed. These topics include the nature of the soft-X-ray background, the physical properties of galaxy clusters, the structure of quasars and active galactic nuclei and the nature of the X-ray emission from compact stars and from the coronas of more normal stars.

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The Search for Extraterrestrial Intelligence: Priority or Pandora's Box?

Arranged by ALAN LADWIG and LEONARD W. DAVID (Forum for the Advancement of Students in Science and Technology, Washington, DC)

Tues., 14 Feb. / Sheraton-Park / Arlington-Alexandria

3:00 p.m.-6:00 p.m.

The Astronomical Perspective.
DR. RICHARD BERENDZEN (Provost, American University, Washington, D.C.)

The Search for Extraterrestrial Intelligence (SETI).
DR. CARL SAGAN (Laboratory for Planetary Studies, Center for Radiophysics and Space Research, Cornell University)

Life in the Universe - Intelligent or Otherwise?
DR. RICHARD YOUNG (Director, Planetary Biology and Bioscience, NASA Headquarters, Washington, D.C.)

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Humans in the Cosmos

Arranged by GERRIT L. VERSCHUUR (Fiske Planetarium, Univ. of Colorado, Boulder)

Wed., 15 Feb. / Shoreham / Diplomat

9:00 a.m.-12:00 m.

The Sun and our Climate. J. MURRAY MITCHELL, JR. (Environmental Data Service, NOAA).

The sun is by far the most important source of energy that drives the global atmospheric wind system, and that establishes the pattern of the earth's climate. It is a quality of both atmospheric winds and climate that they perpetually fluctuate and change. Such fluctuations and change have many plausible origins, and variations in the energy output of the sun are not considered necessary to account for them. Yet, there is now compelling statistical evidence of a connection between solar changes and terrestrial climatic changes on a variety of time scales: (1) Small but systematic changes of atmospheric circulation are apparently related to magnetic "sector boundaries" in the solar wind that sweep past the earth every week or so. (2) The area of the United States that is affected by drought each year is apparently modulated by the 22-year (magnetic) sunspot cycle. (3) There is evidence from C^{14} variations that the "Little Ice Age" of the 15th to 19th centuries may have been related to variations of solar behavior on the still longer time scales of centuries and millennia. These observations lack satisfactory physical explanations. At the least, they imply that the sun is by no means an absolutely steady star, and that the familiar 11-year sunspot cycle is only one of a number of respects in which the sun is capable of variation of a kind that is significant to terrestrial climate.

The relationship between orbital variations and climatic change. JAMES D. HAYS (Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York).

Long term climatic variations in both hemispheres during the last 400,000 years have the same periodicities and constant phase relationship with variations of Earth's orbital parameters (eccentricity, obliquity and precession). Evidence for this is derived from a detailed study of three environmentally sensitive parameters (δO^{18}, Ts, and %C. davisiana) in two subantarctic cores from the Indian Ocean. This work shows: 1. periodicities of expansion and contraction of northern hemisphere ice (δO^{18}), subantarctic surface water temperatures (Ts) and changes in the structure of Antarctic water (%C. davisiana) and all have periods of ~100, 41 and 23×10^3 years which are the same as periodic changes in eccentricity, obliquity and precession respectively during the last 400,000 years; 2. band-pass digital filters centered on these frequencies show that all these frequencies of environmental parameters are approximately in phase; 3. the 41 and 23×10^3 yr. climatic cycles systematically lag the obliquity and precession cycles respectively. Clear demonstration of the relationship between Earth's orbital parameters and climatic change in both hemispheres not only answers the important question of the driving mechanism behind long-term climatic change but also provides a chronology for the last 400,000 years more accurate than any now available from geochemical techniques.

The Influence of the Interstellar Medium on Climate and Life. RAYMOND J. TALBOT, JR (Rice University).

The two most likely effects of the interstellar medium upon terrestrial conditions are (1) the influence upon climate and (2) the possibility that complex interstellar organic material has influenced the development of organic life forms. Climatic effects may have occurred when the Solar System has passed through dense interstellar clouds. There have probably been about 16 passages through clouds with $> 10^3$ hydrogen atoms per cm^3. There will have been major perturbations to the solar wind and galactic cosmic ray environment and enhanced solar UV produced by accretion onto the Sun. Although these 16 passages over the past 4.5 billion years have probably resulted in infintesimal amounts of interstellar organic molecules accreted by the earth ($< 10^{-5}$ g/cm^2), that may have been sufficient seed for an otherwise inorganic primative earth. Probably more important is the organic material in the interstellar cloud from which the solar system formed.

Supernovae and Terrestrial Life MALVIN A. RUDERMAN (Columbia University).

It is likely that Galactic Supernova explosions have had profound effects on terrestial life in a variety of ways· they were probably responsible for both the production and the distribution of the heavier elements present in all living organisms· there are reasons to believe that one such explosion may have initiated the formation of our solar system· subsequent nearby ones may have sufficiently affected the environment of the earth for relatively brief periods to influence significantly then existing flora and fauna.The most vulnerable identified feature of our present environment to nearby (≈ 40 light years) supernovae (or possible explosions of the Galactic center) is our stratosphere's ozone cover Most of it can be removed when sufficiently intense ionizing radiation or γ-rays reach the lower stratosphere and produce very large amounts of the oxides of single nitrogen Such ozone stripping events can occur every few hundred million years and may have had (and may have in the future) important biological consequences.

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Prospects for Life in the Universe: The Ultimate Limits to Growth

Arranged by WILLIAM A. GALE (Bell Telephone Laboratories, Murray Hill, NJ)

Wed., 15 Feb. / Shoreham / Diplomat

3:00 p.m.-6:00 p.m.

Industrialization of Space-NASA Plans for the Next 25 Years. JESCO von PUTTKAMER (Office of Space Flight, NASA).

In planning a long-range space program for the next 25 years, we must be responsive to mankind's near-term needs and wants while building a solid foundation of ethical responsibility and technological capability from which an open, choiceful long-term future becomes accessible. That alone will provide validity to the space program. The industrialization of space can offer a realistic approach to developing a progressive program to provide permanent, practical, and commercial use/tools of space through products and services that create-in the longer run-new values, new jobs, and better quality of life for all mankind. The merits of Space Industrialization lie in the fact that it can benefit all people on earth. Moreover, it would not preclude but indeed validate the option that the industrialization of space may subsequently grow into space settlement as full self-sufficiency in space is approached. By being basically nonelitist, Space Industrialization will thus introduce the true humanization of space.

Limits to Growth Implications of Space Settlement. BRIAN O'LEARY (Physics Dept., Princeton University).

The processing of non-terrestrial materials in space into large structures will enable expansion of the limits to growth on the earth. These include the construction of large human habitats, satellite power stations for providing electricity to the earth, large growing areas to supply food for use in space and on the earth, and the direct recovery on earth of nickel and other resources from asteroids. Opinions are expressed on the impact of these developments on the growth/no-growth debate.

Thinking Small in Space. FREEMAN J. DYSON (Institute for Advanced Studies, Princeton).

The conventional picture of the ultimate fate of the universe in an open cosmology is a dull and dreary prospect of cold dead stars drifting forever in cold dark space. Following Jamal Islam, we ask the questions: "What really happens in an open cosmology after the fireworks are over?" We find, contrary to the prevailing view, that life and intelligence can survive forever. An intelligent society husbanding its resources conservatively can continue to process information indefinitely using a finite store of energy. In addition, if the cosmology is open, any one society is in contact with a number of galaxies that increases indefinitely with time. There will always be fresh things to see and fresh ideas to explore. Just as Kurt Godel proved the resources of pure mathematics to be inexhaustible, the open cosmology makes the resources of life and information inexhaustible.

Models of Long Term Growth. WILLIAM A. GALE (Bell Telephone Laboratories).

The prior talks in this symposium have suggested the possibility of colonizing space. The physical resources of the solar system could support about a sextillion humans. To achieve that we will need to pay as much attention to social structure as to physical structure. At 1% growth rate, it would be achieved in three millenia. A basic distinction exists between models in which interateller expansion follows, and those in which it does not. For models with continued expansion, the probability of such a technological life is at most one per ten thousand galaxies. Models without interstellar expansion can have greater densities of life origination points. The observable consequences are emphasized. Among continuous expansion models, the ultimate intergalactic speed possible differentiates submodels. If the intergalactic speed is the speed of light, two life forms will be mutually ignorant of each other until shortly before contact. If the intergalactic speed is appreciably less, infrared galaxy clusters should be observable at distances corresponding to travel times of about four billion years.

Anthropophysics: The Long Term Context for Intelligent Life. GREG EDWARDS (National Science Foundation).

Many sociologists believe that the long range expectations of a culture have a major and self-fulfilling effect on its structure and development. What are some of our current large scale models and their consequences on the major dimensions of public choice? This talk will sketch a frame work for evaluating alternative strategies of space exploration and exploitation in term of our currently weak models and understandings with on emphasis on making explicit the measures of values used and their basis in physical assumptions. For example, if we assume a big berg universe and current models for the dissipation of entropy, what are the costs of delays in the development and use of technology. If there is other technological life, what might be their motives towards us, and how might we play our chances (internal development versus external expansion). Extrapolating from historical models, physical parameters and plausible technologies, what are some of the major dimensions of large scale community structure that might result, and thus form the context of future evolution.

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Picosecond Lasers in Chemistry

Arranged by WILLIAM SPINDEL and NORMAN METZGER (Natl. Research Council, NAS) and KENNETH B. EISENTHAL (Columbia Univ.)

Thurs., 16 Feb. / Sheraton-Park / Wilmington

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Introduction to Picosecond Lasers in Chemistry, KENNETH B. EISENTHAL (Columbia University)

In the last decade a revolutionary breakthrough has occurred in the study of ultrafast molecular processes. This advance has resulted from the development of lasers which can generate light pulses of the order of 10^{-12}sec. duration and can achieve peak powers in excess of 10^{13} watts. With these ultrashort and ultrapowerful light pulses the investigation of the interactions of light with matter in a time and power domain not previously possible has become a reality. Picosecond lasers thus provide a new and powerful tool for the study of physical, chemical and biological phenomena at the most elementary level. It is in the picosecond time domain that the key steps of electron and proton transfer, energy degradation, molecular motions, and chemical changes often occur. The ultrafast time resolution afforded by picosecond lasers makes it possible to examine the evolution of a molecular system from its initial condition through its various energy states, transient structures and chemical species to the final product. In this lecture some background information on how picosecond light pulses are produced, how their time duration is measured, and some of the general methods used in picosecond laser experiments will be discussed. In addition the application of picosecond lasers to the study of a few chemical problems will be presented.

Investigation of Radiationless Processes with Sub-picosecond Optical Pulses. C. V. SHANK and E. P. IPPEN (Bell Telephone Laboratories, Holmdel, N. J. 07733).

A new source of ultrashort optical pulses with time duration less than a few tenths of a picosecond has been developed and applied to the study of radiationless relaxation processes in molecules and solids. The optical pulses were generated by passive modelocking of a continuously pumped dye laser. The continuous stream of short optical pulses obtained from this system are suitable for time resolved spectroscopy of sub-picosecond resolution. Recent measurements of nonradiative relaxation of the first excited singlet state of

the molecule azulene will be discussed. The influence of solvent and deuteration of the azulene molecule on nonradiative relaxation will be reported. Vibronic relaxation in coronene and the dynamics of conformational changes in 1,1' binaphthyl will also be described.

Picosecond Studies of Primary Events in Bacterial Photosynthesis. MAURICE W. WINDSOR and DEWEY HOLTEN (Department of Chemistry, Washington State University).

Picosecond absorption studies in photosynthetic bacteria show that the primary process of charge separation, by which Nature converts the energy of excited chlorophyll molecules into chemical potential, takes place in less than a billionth of a second. Nevertheless, it has been shown recently that this process actually takes place in several stages and it appears likely that these earliest steps may have a crucial influence on the overall efficiency of photosynthesis. In reaction centres (RC's) of Rhodospeudomonas Sphaeroides it is found that an electron is ejected by an excited bacteriochlorophyll dimer (B Chl)$_2$ in less than 10 ps and takes up temporary (~200 ps) residence on a nearby molecule of bacteriopheophytin (B Ph), before arriving at the ubiquinone "primary" acceptor. Very similar results are obtained for RC's of Rhodopseudomonas Viridis. The finding of a similar step in both species of bacteria suggests that Nature may have learned to harness a portion of the apparent energy losses that attend the sequential electron transfer to structural changes in the photosynthetic membrane, thus enhancing the overall energy efficiency of the photosynthetic apparatus. A detailed mechanism for the electron transfer process will be presented and discussed.

Electronic Relaxation and Tunneling by Picosecond Spectroscopy. PETER M. RENTZEPIS (Bell Laboratories, Murray Hill, New Jersey 07974)

The electronic relaxation of organic molecules has been measured by means of picosecond spectroscopy utilizing pulses of 5 psec duration and 2 cm^{-1} in bandwidth. The primary photo-induced process in visual pigments was found to be proton translocation through a barrier of approximately .3 A. Electronic relaxation in acridine was found to be 35 psec and the effect of solvents on this rate will be discussed.

Early Events of Radiation Chemistry Using Picosecond Pulse Radiolysis Techniques. JOHN W. HUNT (Ontario Cancer Institute, and Department of Medical Biophysics, University of Toronto, Toronto, Canada).

Many complex interactions of the ions, electrons, free radicals and excited molecules produced by a high energy electron beam can be observed by pulse radiolysis techniques. Here, a short pulse of radiation produces the transient species, while an analyzing light beam observes these species. By using a unique stroboscopic system, we have been able to follow many early radiation processes in the picosecond (psec) times. This is possibly due to the properties of a linear accelerator, which produces a train of micro-pulses, each about 10 psec in width, and spaced by 350 psec. The 45 MeV electron beam has the ability of producing the transient species, and also its own flashes of analyzing light. This paper summarizes some of the psec studies carried out by stroboscopic pulse radiolysis systems. For example, the formation of the solvation time of the excess electrons in polar solvents (e^-_{sol}), the strong evidence for the chemical reactions of a precursor of e^-_{sol}, and the history of a cluster of positive ions, excited molecules and e^-_{sol} along the track of secondary electrons show unusual properties. Although considerable strides have been achieved in this field, details of the many reactive species are still in limbo, and therefore new experimental and theoretical approaches may be needed to explain the early radiation processes.

Picosecond Studies of Exciton Migration and Annihilation in Photosynthetic Systems and Crystalline Analogues.* S.L. SHAPIRO and A.J. CAMPILLO (University of California, Los Alamos Scientific Labs., Los Alamos, NM 87545)

The first steps in photosynthesis involve light harvesting by specialized antenna pigment proteins and the efficient energy migration to a reaction center complex. This sequence of events, which takes place on a picosecond time scale can be conveniently monitored by observing the temporal evolution of the fluorescence or absorption from various molecular species upon picosecond light excitation. In the case of chlorophyll emission, the decay time represents an average exciton migration time to the reaction centers. The high powers available from picosecond sources, typically gigawatts, make it possible to achieve high exciton densities and observe exciton-exciton interactions (e.g. annihilation) in-vivo. The manner in which the excitons interact provides an indicator of the topology of the photosynthetic unit. We will report results of quenching experiments performed at Los Alamos on three types of systems; 1) non-photosynthetic systems such as organic crystals of tetracene and anthracene as well as mixed crystalline analogues, 2) chromatophores of various mutants of the photosynthetic bacteria, R. sphaeroides and 3) chloroplasts of Chlorella and spinach. We also report lifetimes on these systems measured with an ultrafast streak camera (3 ps resolution) at room and low temperatures.

*Work supported by U.S. Energy Research and Development Administration.

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Science for the Naked Eye: Or the Physics of Everyday Experience, V

Arranged by ROLF M. SINCLAIR (NSF)

Fri., 17 Feb. / Sheraton-Park / South Cotillion

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Lasers and Art. STEPHEN A. BENTON (Research Labs., Polaroid Corp., Cambridge, Mass.).

An Insects Naked-Eye View of the World. THOMAS EISNER (Cornell University).

Insects, unlike humans, are visually sensitive and behaviorally responsive to ultraviolet light. Ultraviolet patterns occur on both insects and flowers, and they have an important signalling function in the courtship and foraging activities of insects. The patterns are invisible to humans, but they can be rendered visible by photographic and videoviewing techniques. The talk will deal with these techniques, will show how ultraviolet "colors" are produced in nature, and will give evidence of the behavioral significance of such colors to insects.

Grand Design: The Earth From Above. GEORG GERSTER (Author and Photographer, Zurich, Switzerland)

Aerial photography (from aircraft, as opposed to space photography) is more than just a tool for planning and resource assessment (and other utilitarian purposes). With striking images of man's interaction with his planet it provides unique food for thought. Photographs of all parts of the world will be shown.

The Physics of Karate. MICHAEL S. FELD (Assoc. Prof. of Physics, MIT), RON McNAIR (Hughes Research Labs., Malibu, Calif.), and DAVID FELD and JONATHAN FELD (Students, Meadowbrook Junior High School, Newton, Mass.).

Astronomy Before Columbus. ANTHONY F. AVENI (Colgate University).

With the European Renaissance as a dividing line in both space and time, we will focus on a discussion of the role of positional astronomy in pre-technological Old and New World Science. Special attention will be paid to the naked eye astronomy which dominated pre-Renaissance western Europe and particularly pre-Hispanic America. The elements of Maya calendar, one of the foremost intellectual achievements of Ancient America, will be discussed as one of the theoretical models which was derived from repeated naked eye observations of increasing sophistication. Finally the role of non-astronomical factors in the evolution of the Native American calendar will be brought to bear on the discussion.

The Energetic Cost of Moving About. VANCE A. TUCKER (Prof. of Zoology, Duke University).

6. CLIMATE AND LAND USE

Impacts of Recent Weather Extremes in the United States

Arranged by J. MURRAY MITCHELL, JR. (NOAA)

Mon., 13 Feb. / Shoreham / Club A
9:00 a.m.-12:00 m.

The Atmospheric Causes of the Recent Drought and Cold Winter. DONALD L. GILMAN (NOAA/National Weather Service).

While the ultimate causes of particular weather anomalies like the severe fall and winter cold of 1976-77 and the Western drought of 1976-77 and its California predecessor of 1975-76 remain unknown and perhaps unknowable, the immediate role of the atmosphere's upper wind currents in these events can be described. Those currents took on a fairly typical winter configuration before the end of September 1976, developed it to exceptional intensity during the fall, and maintained it with remarkable steadiness through a climax in January 1977 caused by new developments in the Arctic. Quite different and unrelated upper-wind currents the previous year had already given California one dry winter, to which the widespread western dryness of 1976-77 came as an unlucky sequel.

Nineteenth Century Precedents for Recent Weather Extremes. DAVID M. LUDLUM, Weatherwise.

Extreme weather events of the nineteenth century are surveyed. Some of the highlights are analyzed and compared with similar weather extremes in recent years. A chronology of severe winters in the nineteenth century is presented, and winters of the past compared with the winter of 1976-77 by means of a simple winter severity index employing degrees days and total snowfall. Evidence of climate change during the nineteenth century is examined, and the climate change study of Prof. Elias Loomis of Yale analyzed in modern perspective.

An Overview of the Impacts of Drought and Cold Winter, 1976-77. NORTON D. STROMMEN (Director, NOAA/EDS Center for Climatic and Environmental Assessment.)

The cold and drought of the 1976-77 winter season has impacted the lives and pocketbooks of every American, either directly or indirectly. The total economic losses resulting from this hostile weather will never be fully known. By early fall of 1976 the potential impacts and magnitude of the drought were readily visible in terms of crop yields, premature defoliation of the deciduous hardwoods and browning of many types of coniferous trees. Failure of the fall rains left soil moisture supplies at critically low levels and forced the farmer to reevaluate his management strategy for the 1977 growing season. The cold temperatures sent heating bills soaring to new record highs in most of the area east of the Rocky Mountains. As the situation reached a crisis level, in mid-January over the eastern one-third of the nation, NOAA's climatological and weather forecast services responded by developing a new assessment capability to provide estimates of the natural gas requirements for residential heating for the heating season. This capability has now provided greater insight into those regions of the U.S. where economic benefits for heating cost reductions can be maximized through effective use of insulation and reduced natural gas consumption.

Water Resource Problems Arising From The Drought In California. RONALD B. ROBIE (California Department of Water Resources).

The drought in California surpassed any event in recorded history -- with the result that related problems were extensive and severe. The drought began with the 1975-76 water year which was the third driest in history up to that time. It was followed, however, by the driest year of record in 1976-77. Because of California's extensive system of State, federal and local projects, drought problems in 1975-76, though serious, were somewhat isolated. During 1976-77, however, the cumulative effects of record and near-record dry years back-to-back resulted in statewide problems impacting agriculture, industry, the economy, environment, and the general public. Additional impacts included the energy situation because of reduced hydroelectric generation, the recreation picture, and a critical fire problem in forests and brushland. The drought situation also forcefully pointed up a number of corollary problems in addition to the direct impacts. These included identifying the need for legislation on drought related problems, the need for more efficient and effective drought disaster relief, and the need for dependable long-range weather forecasting. Institutional problems also surfaced because of the drought. These problems were in such areas as California water laws, police powers for such actions as mandatory conservation, and State-federal relationships and responsibilities.

Impacts of Recent Weather Events on Agriculture-Oriented Business. PHILLIP F. SISSON (The Quaker Oats Company)

The economic impact of recent weather events on agriculturally oriented businesses has been significant. The drought in the Western states and the reduced availability of water for irrigation has resulted in higher costs of production for numerous agricultural products due to the need to drill new and deeper wells and the heavier requirements for energy needs for pumping water. Concern over the low subsoil moisture that existed throughout much of the Midwest last spring as a result of the drier than normal fall and winter of 1976 77 was followed by a summer that could be characterized as close to ideal. Prospects are for record grain and oilseed production that have already caused commodity prices to drop to the lowest levels recorded since 1973. Foreign demand for U. S. commodities are also expected to diminish as weather and crop output worldwide have improved. A return to large surpluses of grain has caused the U. S. government to place restraints on acreage planted for 1978. American farmers are likely to be faced with a number of years of low or non-existant returns. Implications for businesses that supply farm markets are reduced sales, especially for farm machinery and fertilizer areas. The surpluses in grain, however, mean greater sales for businesses involved in grain storage facilities. Other economic consequences related to weather were plant shutdowns due to lack of fuel during the intense cold weather of early 1977. This loss in production will not be made up in most cases, so overall GNP will be reduced.

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The Scientific Basis of Modern Weather Forecasting

Arranged by FREDERICK G. SHUMAN (Natl. Meteorological Ctr.)

Mon., 13 Feb. / Shoreham / Club A
3:00 p.m.-6:00 p.m.

What are the Physical Methods of Forecasting the Weather? N. PHILLIPS (National Weather Service, NOAA)

Organized weather forecasting was originally based on extrapolating the motion of weather systems. The development of a global observing network and of high speed computers has made it possible to forecast some of the important weather features by numerically solving the physical laws governing atmospheric processes. These laws include the Euler hydrodynamic equations, thermal radiation processes, thermodynamics, and empirical descriptions of small-scale turbulence. The numerical methods employed range from elementary grid-point finite differences to spectral transforms and finite elements. At the present time only large-scale weather systems are amenable to this approach; hurricane tracks might be so treated, but tornados and local thunderstorms must still be predicted by other means.

Combining Statistical with Physical Methods to Improve Forecasts. C. E. LEITH (National Center for Atmospheric Research*)

Statistical forecasting by regression methods is based on observed correlations between multivariate predictors and predictand variables. In choosing predictors it is possible to use future values that have been forecast by physical methods as well as present or past observations. With such a combined method the National Weather Service routinely predicts detailed weather variables, like maximum daily local temperature, which are not computed directly by physical numerical models. Probabilistic forecasts, such as of the likelihood of precipitation, are also produced in this way. The correlations needed for the regression scheme must be determined from finite data sets made up of past observations and forecasts. Statistical sampling errors in the determination of regression coefficients limit the number of useful predictors to about 10, and screening methods are used to select the best predictors. Regression methods provide not only a best estimate of any predictand variable but also a measure of the uncertainty of that estimate. When applied to the prediction of explicitly computed model variables, the regression scheme corrects systematic model errors, and the associated diagnosis of error is of value in research on the improvement of physical models.

*Sponsored by the National Science Foundation.

How are the Methods Practiced and What are the Benefits to the General Public? DR. GEORGE P. CRESSMAN (National Weather Service, NOAA)

The special requirements for scientific (numerical) weather prediction call for the use of a very large computer and for rapid assembly of at least hemispheric data. Thus a centralized operation is called for. The results of the calculations of the future days' charts of weather elements are then transmitted to a network of weather forecast offices. At these, meteorologists critically review the information received and formulate the worded forecasts for the ultimate users; the general public, aviation, shipping, agriculture, forestry, pollution control and others. Because all weather forecasts decay in time the complexity (and ultimate accuracy) of the computer calculations must be weighed against the time needed to finish the process. Verifications of one to two day forecasts show the accuracy of the final product reaching the public over the last 20 years closely parallels the accuracy of the basic charts from the computer. Contrary to popular mythology weather forecasts have improved substantially over the period of numerical prediction. Further, public forecast accuracy responds quickly to improvements in the numerical models used.

A Larger Context: Atmospheric Modeling as a Research Tool. JOSEPH SMAGORINSKY (Environmental Research Laboratories, NOAA)

Mathematical and physical research over the past 30 years has provided the basis for constructing computer models capable of producing weather predictions that have become increasingly accurate, covering more atmospheric properties, and valid over longer intervals, over great geographical areas and to higher altitudes. This type of simulative capability has also become an essential tool for research on atmospheric phenomena of smaller characteristic scales (such as turbulence, thunderstorms, fronts and hurricanes), on oceanic phenomena (such as coastal and equatorial currents, as well as the general circulation of the World Ocean) and on the atmospheres of other planets (such as Mars, Venus, Jupiter and Saturn). Advances in computer modeling, complemented by observational studies, theoretical analysis and, where possible, laboratory experiments, promise to yield new applications benefits such as understanding climatic change and its sensitivity to human activities.

Can We Ever Predict Weather and Climate?
E. N. LORENZ (Massachusetts Institute of Technology)
The development of techniques for producing essentially perfect weather forecasts has sometimes been set forth as a major goal. More recently, the desirability of predicting future changes of climate has been receiving the spotlight. Current research indicates that the first goal is unattainable. This is so because, in effect, the atmosphere does not completely make up its mind what to do until just before doing it. Whether climate is in principle predictable remains something of a mystery.
A realistic research strategy would be first the determination of just how accurately it is possible to predict the atmospheric conditions a given number of hours, days, months, or years in advance and then a concentration of effort on those ranges where there is the greatest discrepancy between what has currently been achieved and what is achievable.

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Hail Suppression, Impacts and Issues: A Technology Assessment

Arranged by BARBARA C. FARHAR (Human Ecology Research Services, Inc., Boulder, CO)

Tues., 14 Feb. / Shoreham / Club A

9:00 a.m.-12:00 m.

Overview of a Technology Assessment of Hail Suppression
STANLEY A. CHANGNON, JR. (Illinois State Water Survey).

An extensive technology assessment of hail suppression in the United States during the next 20 years was conducted by an interdisciplinary team of 13 scientists, each with an extensive background in weather modification research. The assessment was based on a review of all past and present information and activities. The collation of this information on the atmospheric, technical, social, legal, environmental and economic aspects was used to develop models of future technological capabilities and then to predict future adoption of hail suppression in the nation. These adoption patterns were used to assess the various economic, legal, social, and environmental impacts. The research team used these impacts to identify possible policy action options and then made a series of recommendations for local, state and federal government entities; for scientific research, and for affected businesses.

The National Economic Impact of Future Hail Suppression Technologies. C. ROBERT TAYLOR (Texas A&M University), and JON VAN BLOKLAND (University of Florida).

This paper presents estimates of the national and regional economic impacts of the adoption of three hail suppression technologies, each with different performance capabilities and adoption patterns. At the national level, the economic impacts studied focus on the effect of adoption on the fiber crops to the point of consumption. At the regional level, shifts in cropping patterns that are likely to occur as a result of hail suppression on returns to landowners is examined and the effect on commodity prices is considered. Finally, a national benefit/cost ratio was computed. Two of the three hail suppression technologies were found to have benefit/cost ratios substantially greater than one. These economic impacts were estimated with a national economic model of agriculture.

Estimation of Potential Value of Future Research STEVEN T. SONKA, (University of Illinois)

This paper details a methodology useful for evaluating the potential value of proposed research. Use of this methodology requires determination of three useful sets of data: (1) the net benefits associated with varying degrees of successful completion of the research, (2) the probabilities of achieving different levels of success, and (3) the expected costs of conducting the research. Integration of these sets of data allows computation of an expected net benefit estimate which would be comparable with competing research efforts. An illustration of use of the technique is provided for hypothetical weather modification example.

Public Policy and Research Policy Issues of Hail Suppression. DEAN E. MANN (University of California, Santa Barbara)

This paper will deal with the public policy issues, including science policy issues, that concern the development of the technology for hail suppression. These issues are to some extent ancillary to the more general policy issues involved in the development of weather modification generally. These issues involve such questions as the level of public funding for scientific and applied research; whether the focus of such research should be on basic atmospheric processes or more applied technology; institutional arrangements for fostering research; the regulation of hail suppression, including such matters as the political level of such regulation and the organizational arrangements for regulation; mechanisms for public participation in decision making with respect to adoption and management of hail suppression; institutional arrangements for compensating those whose interests may be damaged by hail suppression activity.

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Remote Sensing Applied to Meteorology and Hydrology

Arranged by DAVID S. JOHNSON (NOAA)

Tues., 14 Feb. / Shoreham / Club A

3:00 p.m.-6:00 p.m.

Ground-Based Remote Sensing. C. GORDON LITTLE, (Wave Propagation Laboratory, Environmental Research Laboratories NOAA).

This talk summarizes the status of ground-based remote sensing of the atmosphere. The potential advantages (and disadvantages) of remote sensing are first identified, and the complementary nature of ground-based and satellite remote sensors stressed. The status of ground-based remote sensing is then summarized in terms of acoustic, optical infrared, and radio techniques for the measurement of wind, temperature, water vapor, clouds, precipitation, and aerosol. Dramatic improvements in the quality and scope of short-term local weather services could be obtained by exploiting the complementary capabilities of ground-based and satellite remote sensors, in a system which also incorporates the latest in data processing and TV dissemination.

Numerical Models and Satellites - Partners in Weather and Climate. VERNER E. SUOMI (University of Wisconsin).

Weather prediction has changed from an art to a science. This has resulted from theoretical advances in the atmospheric sciences coupled with the advent of two major new technologies: large, high speed computers and remote sensing of the atmosphere from satellites viewing the entire Earth. With this new capability in hand, a major effort to treat the global atmosphere as a closed physical system will begin in 1978. Climate is more difficult, but the same approach looks promising.

Operational Uses of Satellite and Radar Data in Synoptic Meteorology. VINCENT J. OLIVER (National Environmental Satellite Service/NOAA).

During 1977, satellite pictures and radar data were available to operational forecasters throughout the United States. The satellite data was available once every 30 minutes, while the radar data could be programmed from every two minutes to once per hour. Satellite sounding data and winds derived from cloud motions were fed into computers at the NMC and used to help with the analyses from which the predictions for time periods of 12 hours to five days were prepared. Satellite data has proved especially useful in the following areas. We routinely locate all tropical disturbances, track them, monitor their growth, and determine their strength as they grow into hurricanes. Never again will a hurricane approach our shores or threaten a shipping lane anywhere in the ocean without prior detection by satellites. Radar and satellite data together are giving us a much better understanding of how thunderstorms form and why, and where they will grow into tornados. The destructive winds from thunderstorms and their dangerous effects at airports are being seen with remote sensors which may soon lead to safer techniques being developed for avoidance of these storms. Storm development, fog formation and dispersion, and air pollution are all yielding to the combined searching from our satellite and radar remote probes.

Use of Remote Sensing of Hydrology. V. V. SALOMONSON (Goddard Space Flight Center, NASA), E. L. PECK (National Weather Service, NOAA), D. R. WIESNET (National Environmental Satellite Service, NOAA).

Remote sensing is proving to be an increasingly useful observing tool for hydrology and water resources management. Tests show that rain-gage-adjusted, radar estimates of precipitation are superior to rain-gage estimates alone. Aircraft sensor observations of natural gamma-ray absorption and microwave emission are demonstrating definite sensitivity to soil moisture variations and varying snowpack conditions. Both geostationary and polar-orbiting operational environmental satellites are providing snowcover information over large watersheds and hemispheric regions and ice cover information in the Great Lakes and polar regions. Observations from the Landsat series of satellites are being studied and applied for snowcover mapping on local and regional watersheds, surface water and wetlands monitoring, and land use mapping for watershed planning and flood frequency/storm water management studies. The present applicability of remote sensing is still limited; however, the outlook for future improvements in the availability and use of remote sensing systems for hydrology is bright. Advanced radar and attendant information dissemination are gradually being implemented over much of the U.S. Within a few years, advanced operational and experimental satellite systems will provide improved capabilities including observations in nearly all spectral regions from the visible to the microwave region.

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Whither LANDSAT? Future Directions for Earth Observation Data Management Systems

Arranged by LESTER F. EASTWOOD, JR. (Washington Univ.) and CHRISTOPHER T. HILL (Office of Technology Assessment)

Wed., 15 Feb. / Shoreham / Club A

9:00 a.m.-12:00 m.

Industry's View of the Operational Landsat. DANIEL J. FINK (Vice President and General Manager, General Electric Space Division).

This paper assesses government and industry roles in an operational earth observation system. It examines the components and operation of the system from the industry's viewpoint, stressing industry's function in the transition from experimental to operational status. Requirements for assuring widespread beneficial use of earth resources data are also discussed.

Issues Related to Establishment of an Operational Earth Resources System. A. DONALD GOEDEKE (Director, Special Programs, NASA)

This presentation will focus on the issues related to the establishment of an operational earth resources system. Specifically, the following issues will be discussed: how to finance the system; institutional management; foreign involvement; private industry role; market needs; cost benefit. These issues are being considered by the Federal Coordinating Council of Science, Engineering and Technology (FCCSET).

Remote Sensing in Developing Countries. CHARLES K. PAUL (Manager, Remote Sensing, Agency for International Development).

Remote sensing technical assistance in developing countries has in the past taken the form of grants, training, and demonstrations of specific applications for resource identification, location, and measurement. The present U.S. government emphasis is the development of regional remote sensing training and user assistance centers with the encouragement of orderly development of global LANDSAT receiving stations to make use of important satellite data. The higher spatial resolution of future satellite sensors such as the thematic mapper on LANDSAT D will result in an average increase from 30% to 60% of the developing world's agricultural fields accessible to measuration for purposes of crop prediction. This increase has significant impact in applying area frame sampling techniques with assocaited potential benefits in diverting mass starvation due to unexpected crop shortfalls. This type of social benefit encourages serious consideration for an operational earth resources satellite system.

An Earth Observation Data Management System for State, Regional, and Local Agencies: Economics, and Policy. LESTER F. EASTWOOD, JR. (Associate Director, Center for Development Technology, Washington University, St. Louis, MO), ROBERT P. MORGAN (Director, Center for Development Technology, Washington University, St. Louis, MO)

There is a wide gap between the digital format in which raw, satellite-derived information is presently produced by the federal government, and the tabular and map formats in which natural resources information is currently of most use to state agencies. This paper considers the issues involved in bridging this gap. Specifically, it considers the economic, institutional, and policy implications of alternative designs for remote sensing-based information systems serving state, local and regional agencies.

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Desertification: Issues in Measuring and Monitoring the Process with Indicators

Arranged by PRISCILLA REINING (AAAS)

Wed., 15 Feb. / Shoreham / Club A

3:00 p.m.-6:00 p.m.

Problems with the use of Plant Species to Indicate Desertification. ELINOR TERHUNE (National Science Foundation).

Excessive harvesting of plant materials by humans and their domestic animals leads to alteration of plant communities that are adapted to arid and semi-arid environments. Some plant species that are resistant to grazing pressure are key indicators that desertification is taking place. Identification of indicator species requires location-specific research and use of indigenous knowledge, but some general characters of xerophytes may be helpful in locations where no data base has been established.

Problems in the Development of Social Indicators of Desertification. BRIAN SPOONER (University of Pennsylvania)

The task of the social scientist in the campaign against desertification is twofold. On the empirical level, he must determine and describe in detail those types of human activity that in certain climatic and edaphic conditions potentially lead to desertification, and develop methodologies for monitoring and measuring their progress where they occur. On the theoretical level, he must integrate social and cultural data into a comprehensive systemic approach to ecological problems. The problems confronting the social scientist in both these directions are complex and differ significantly from those faced in the other relevant sciences. Recent work is beginning to produce promising results. In the long term progress in combatting desertification depends on understanding the dynamics of the human use systems that lead to it.

Social Processes Affecting Desertification in Developed Economies. JOHN W. BENNETT (Washington University).

Social and economic behavioral patterns found in growth oriented economies can lead to resource abuse in semi-arid areas. The problems of determining precisely how this occurs, whether it can be predicted and the means by which it can be controlled will be exemplified through processes such as land use, resource allocation, urbanization, recreation and commercial agriculture. There are problems of synchronization between social factors and physical manifestation of resource degradation (desertification) because productivity can rise for a period after the start of overall degradation. These processes can be quite different in developed economies from that of developing ones.

Use of Indicators in the Mexican Experimental Station. MARTIN H. GONZALEZ (Instituto Nacional de Investigaciones Pecuarias - SARH)

Fourteen test sites distributed among range, dryland and irrigation land use types in central Mexico have been selected for monitoring desertification with the physical, biological and social indicators chosen in Nairobi as the chief work of the Science Associations' Seminar. Initial experience with the indicators in these settings suggests problems and possibilities for the comparative use of the indicators and the adaptations which will be necessary for their continued use in conjunction with the Rancho Experimental La Campana.

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Assessing Natural Resources: Science, Land Use, and Public Policy

Arranged by JAMES R. BALSLEY and HAROLD L. BURSTYN (U.S. Geological Survey, Reston, VA)

Thurs., 16 Feb. / Shoreham / Club A

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

The Geological Survey of Great Britain: Its Origins and Early Development. DOUGLAS A. BASSETT (National Museum of Wales).

The Geological Survey of Great Britain was formed in 1835. Its work was, in part, anticipated by the Board of Agriculture and the new institution has been described as 'the acknowledged child of the Ordnance Survey and the Geological Society (of London).' The influence of these three bodies will be considered in the paper in the context of the general scientific and economic climate of the time.

The States Survey Their Lands. MICHELE L. ALDRICH (American Association for the Advancement of Science).

State geological surveys, begun in the 1820s, provided information for their government sponsors on land use and science policy. Early surveys reported on state-regulated industries such as salt manufacture. Legislators and governors expected their geologists to assist state-endorsed transportation systems. State surveyors studied supplies of coal and oil as part of a broad concern with economic development. They advised on effective use of farm land and recommended solutions to problems of water supply. The cartographic projects of state surveys proved useful in boundary determinations, mining projects, and other land use questions. The geologists promoted the idea of wilderness as a valuable resource through their reports' illustrations, which highlighted scenic as well as scientific aspects of landscapes. Although the phrases "land use" and "science policy" were not employed to describe what the surveys were doing in the decades before the founding of the federal survey in 1879, they do summarize a major portion of the state geologists' responsibilities.

The Geological Survey of Canada: A Pioneer of Government Science.

MORRIS ZASLOW (University of Western Ontario, Canada).

Founded in 1842 to explore the mineral potentialities of the then Province of Canada, the Geological Survey quickly gained a world reputation under Sir William Logan's direction both for its outstanding work on a broad range of natural phenomena and for its contributions towards solving fundamental problems in the earth sciences. During its 135 years the Survey has steadily pursued its work within the context of Canada's expansion to continental proportions, changing support and direction from governments, and shifting public interests. The paper will examine the changing emphases in the Survey's activities over time and its relations with its sponsor and with other public and private agencies. Finally, it will attempt to evaluate the Survey's major contributions and to assess its significance as a pioneer scientific organization within the federal public service of Canada.

The Territorial Surveys and the Founding of the U.S. Geological Survey.

HAROLD L. BURSTYN (U.S. Geological Survey).

After the Civil War, America expanded westward, settling its vast western half in a generation. Exploration barely preceded settlement; from 1867 to the end of the 1870's four different surveys brought to the American West the latest methods of earth science. Each had a distinctive thrust that came in part from the combination of agency and congressional support used by its leader to promote his work. Hayden began in the General Land Office, became independent, and promoted the setting aside of Yellowstone as the first national park. Powell moved from exploring the last unknown region to understanding the problems posed for agriculture by the shortage of rainfall in the arid West. King used the traditional sponsors of exploration, the Army Engineers, to bring the newest European methods to the geology of the American West. Wheeler continued the tradition of exploration by military officers. After a decade's headlong expansion, of which the Territorial Surveys were an appendage, the twin thrusts of political reform and bureaucratic rationalization led to an attempt to reorganize the public land system and consolidate the surveys into a single powerful agency. The result, the founding in 1879 of the U.S. Geological Survey, achieved only the least part of the reformers' aims. Yet, after a century of scientific achievement and political integrity, the Survey may now be able to assist in bringing about the rational use of the public domain for which it was founded.

Choosing Sites for Power Plants.

HENRY W. COULTER (U.S. Geological Survey).

Geologic and seismic aspects of siting are important factors in selecting and evaluating sites for any large power plant, and especially those for nuclear plants. Before engineering design criteria can be established for a proposed facility, the engineering geologist must provide reasonable assurance that the site is feasible. Ideally a site should be in a geologically stable area--one low in seismicity, free of active faults, underlain by competent foundation materials, and free from the adverse effects of other geologic hazards. Deficiencies in any of these aspects must be compensated for by engineering design. The size of the area to be investigated and the scope of the investigations will be determined by the type and size of the proposed facility, by the local and regional geologic and seismic environments, and by the degree of hazard or risk to public health and safety involved should the facility fail. Geologic conditions and engineering characteristics of foundation materials at the site must be carefully assessed to determine the adequacy of the foundation. Tectonic features and potential seismicity of the region must be evaluated to establish a basis for determining the maximum expectable earthquake intensity at the site and the potential for surface faulting.

Land and Water Resource Information Needed for Joint Private - Public Planning of Mining and Mine Reclamation.

EDGAR A. IMHOFF (U.S. Geological Survey, RALI Program)

Research conducted by the U.S. Geological Survey (USGS) through its program on Resource and Land Investigations(RALI) reveals several instances in which public planners and private mineral extraction companies are cooperating in developing and implementing plans for mining, reclamation, and post-mining use of mineral deposit sites. Economic, political, and legal factors are inducing this cooperation. Urban sprawl preempts valuable mineral deposits and spurs demand for public facilities. Increasingly, mineral extraction companies and public planning bodies are facing common political pressures which make early and open announcement of intentions advisable. Mined-area reclamation laws are requiring mineral extraction companies to obtain the approval of affected public planning bodies for certain kinds of mining and reclamation and selected post-mine land use. Interpretive reports on land and water resources are available for some joint planning efforts but, generally, land and water resource data are inadequate, and interpretive reports are few. The USGS conclusions are based on case studies showing selected relationships between public planning bodies and mineral extraction companies in Arizona, Colorado, Florida, Illinois, and West Virginia.

Regional Planning and Practical Politics: The Irrigation Survey of 1888-1890.

JOHN ALEXANDER WILLIAMS (West Virginia University).

American regionalism--the concept that "natural" regions, particularly watersheds, are superior to traditional political subdivisions for the purposes both of analyzing and administering American economic and social development--is rooted in the work of John Wesley Powell during the years (1878-1894) when he was serving as architect and director of U. S. G. S. The concept of physiographic provinces as extended and popularized by Powell and his co-workers was central to the later development of regional concepts among geographers, economists and other social scientists. Such ideas encountered resistance among politicians and developers, however. The notion of tying land use and other development policies to a scientifically-determined geographic base affronted politicians who preferred jurisdictions designed for party and business advantage. The concept of long-range planning promoted the public interest at the expense of developers whose immediate and private concerns found ample representation in local and congressional politics. The battle over the Irrigation Survey brought these conflicts into the open and generated a debate over land use policy that foreshadowed many of the issues generated by regionalism and regional planning in the 20th century.

The Use and Abuse of Water: Floods, Dams, and Zonin .

D. M. THOMAS (U.S. Geological Survey).

Historically, available data and the prevailing understanding of the hydrologic process serve as the basis for developing and managing water resources. Correcting inadequate plans and designs resulting from incomplete knowledge, and modifying development for changed objectives require new data and an improved understanding of the hydrologic system. At present, comprehensive data together with socioeconomic considerations in sophisticated analyses are required in the decision process. Case histories on aspects of the Erie Canal, New York City's water supply, Federal Flood Insurance, and urban storm-water management illustrate the influence of resources information on water developments.

Earth Science and Land-Use Planning in the San Francisco Bay Region.

ROBERT D. BROWN (U.S. Geological Survey).

Three goals, widely recognized in regional and community planning, are, 1) to provide for continued growth and development, 2) to protect public health and safety, and 3) to protect the natural environment from undue degradation. The earth scientist helps planners and decisionmakers achieve balance between such goals by providing information on natural hazards (floods, earthquakes, landslides), natural resources (water, construction materials, minerals), and the capability of the land to support different uses. The U.S. Geological Survey has contributed to the planning process, to plan implementation, and to engineering applications by providing both basic and interpreted data. Between 1970 and 1976 Survey scientists with the San Francisco Bay Region Environment and Resources Planning Study published more than 100 maps and reports that explain the scientific background of land-use issues. Their data--now incorporated into plans, ordinances, regulations, and State laws--are used by cities, counties, regional governmental commissions, the State of California, and by public interest groups. Research fostered by the Study has also significantly advanced our knowledge of the San Francisco estuarine system, of Quaternary tectonics and deformation, of erosional and depositional coastal processes, and of the geologic and hydrologic processes that control slope failure and mass-wasting.

Earth Science Data: Its Collection and Use in the State of Connecticut.

HUGO THOMAS (State Geologist, State of Connecticut).

During the past decade there has been a significant increase in the use of natural and applied science data in the process of government. In Connecticut the collection and dissemination of natural resource information is coordinated by the Natural Resources Center of the Department of Environmental Protection. Data collection programs of the U.S. Geological Survey and other federal and state agencies are managed by the Center to provide a comprehensive base of natural resource information. Data is disseminated through publication, technical assistance, and workshops at regional and local levels of government. The results have been a significant increase in the use of natural resource information for land-use decisions and more effective management of data collection programs to produce more useful map and descriptive products.

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Climatic Futures

Arranged by ROBERT M. WHITE (NAS)

Fri., 17 Feb. / Shoreham / Club A

9:00 a.m.-12:00 m.

Recent Climatic Fluctuations and the Outlook for the Future.

H. E. LANDSBERG (University of Maryland).*

There has been no major global climatic changes in the past 11,000 years. But fluctuations with time periods of hundreds of years down to interannual variations are part of the current climatic era. Instrumental records of climate now span about two centuries, and fairly useful records of major weather events go back another three centuries in Europe. Some proxy data, such as tree rings, cover the same interval fairly reliably. We can compare recent decades with this earlier information. Such comparisons show that recent droughts, cold winters, hot summers and tropical storm disasters are not unprecedented. Most of them have earlier analogues. Their socio-economic impact is, however, worse in a crowded world. There is no indication that any radical climatic change is under way. Using this as an assumption, one can use the past record to make climatic anomalies in the near future calculable risks.

*Meteorology Program, University of Maryland, College Park, Maryland 20742.

Climatic Limits to Growth: How Soon? How Serious?

STEPHEN H. SCHNEIDER (National Center for Atmospheric Research, Boulder, CO 80307)*

The "limits to growth" debate has been centered, in large measure, on the trade-off between the benefits of economic development and the environmental and other risks of such development. One of the potentially most serious, and uncertain, class of risks is associated with global climatic modification. The primary prospects for such changes are associated with the substantial human interference in the global chemical cycles of life, particularly the carbon and in nitrogen cycles. In addition, the modification of land surfaces and release of some chemicals and heat to the environment are also possible causes of climatic changes. The magnitude of the problem, and the relative time scales for which research is likely to narrow uncertainties compared to the time frame in which the atmosphere will "perform the experiment" for us, will be highlighted.

*The National Center for Atmospheric Research is sponsored by the National Science Foundation.

Mathematical Models and Sensitivity Studies of Climate

SYUKURO MANABE (Geophysical Fluid Dynamics Laboratory/NOAA, Princeton University, Princeton, NJ 08540)

Recently, significant progress has been made in the development of mathematical models of climate. If the behavior of these models is sufficiently realistic, one can use these models for evaluating the response of climate to external or internal stimuli such as the increase of CO_2 content in air (sensitivity study). Some preliminary results of sensitivity studies with highly simplified models indicate that doubling the carbon dioxide content in the atmosphere can cause very significant changes in the distributions of climatic variables, i.e., temperature and precipitation rate. Future strategy is discussed for further improvement and validation of climate models, in particular, the joint ocean-atmosphere model.

The Geological Record and Future Climate.

JOHN IMBRIE (Dept. Geol. Sci., Brown University, Providence, R.I. 02912).

The geological forecasts of future climate under consideration here are models of how the system can be expected to behave at frequencies in the range 10^{-5} to 10^{-3} cycles per year -- in the absence of anthropogenic effects. There is substantial evidence that a sizable fraction of climatic variance at periods ranging from 100,000 to 20,000 years is a response to variations in the earth's orbit. A simple numerical response model (which accounts satisfactorily for the climatic history of the last 150,000 years) indicates that over the next 20,000 years the joint effect of these astronomical cycles would be an extension of the trend toward cooling and drying which began about 6,000 years ago, and which would continue as climate returns to its ice-age mode. Superimposed on this trend are lower-amplitude fluctuations of uncertain (possibly solar) origin, with an average period on the order of 2,000-3,000 years. Over the next millenium or so, the combined effect of these natural cycles would be a warming trend. Not surprisingly, the geological record indicates that the sense and especially the amplitude of these fluctuations are strongly site-dependent, with the greatest changes occurring near the mean position of oceanic and atmospheric fronts.

An Experiment in One-to-Ten Year Climate Prediction.

Reid A. Bryson (University of Wisconsin-Madison).

The Climate/Food Research Group at the University of Wisconsin has developed a simplified statistical-dynamical model for predicting monthly mean pressure, temperature and rainfall patterns for several years in advance. The initial assumption is made that variance at periods longer than five years or so is primarily due to variations in the heat budget of the hemisphere as a result of variations in atmospheric transparency, while variance from one to seven years or so is in part due to Chandler tides. Tests on independent data indicate some skill. Implications for further research will be discussed.

7. BIOLOGICAL SCIENCES

The Physiology of Ions in Muscle and Other Cells

Arranged by MARY E. CLARK and PAUL PAOLINI (San Diego State Univ.) and GIUSEPPE INESI (Univ. of the Pacific Medical Center, San Francisco)

Mon., 13 Feb. / Sheraton-Park / Wilmington

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Extracellular Osmolarity and KCl Distributions in Living Muscle. R.W. FREEL (University of California at Los Angeles).

The generality of the Donnan model was studied by examining the behavior of K and Cl in the muscle fibers of osmoconforming crustaceans which naturally tolerate up to four fold changes in the osmolarity and ionic composition of their body fluids. Donnan theory predicts that during osmotic adaptation the relative change in cell Cl will be large, while that of K will be negligible. Chemical analyses of the muscle fibers of various crustaceans are in accord with these predictions. However, since water and solutes may be distributed heterogeneously, these observations can only qualitatively confirm the theory. A more critical test of the Donnan model requires the equilibrium potentials of K and Cl to be equal to the membrane potential. Shrimp with blood osmolarities from 350 to 1600 mOsmolar have muscle fibers which do act as good K or Cl electrodes (with a small Na contribution). Most important, the transmembrane activities of K and Cl (measured with ion electrodes) are such that $E_K \simeq E_{Cl} = E_m$. It is concluded that the net movements and equilibrium distributions of K and Cl in the muscle of osmoconforming crustaceans are adequately represented by Donnan theory, even when these organisms are living in diverse osmotic environments.

Difficulties with Donnan Theory in Developing Tissues. C.F. HAZLEWOOD (Baylor College of Medicine)

The equilibrium theory of Donnan, which was tested in physical systems, is often utilized to describe electrolyte distribution in biophysical and living systems. Donnan's original theory is based on the following assumptions. (A) Existence of a discrete semipermeable membrane, (B) Existence of impermeant charged solute specie on one side of the membrane, and (C) The ionic species located on both sides of the membrane obey the laws of ideal solutions. Donnan and his colleagues reached several conclusions as a result of their experiments with systems that were consistent with the assumptions (A)-(C) above. When the theory is applied to living tissues and cells, the conclusions become integrated with the assumptions (A)-(C) defining "Donnan behavior". These conclusions are as follows: (A') $[K]_i/[K]_o = [Cl]_o/[Cl]_i$; and (B') Voltage = $RT/F \ln[K]_o/[K]_i$. In the case of developing muscle, the conditions set forth in (A') and (B') are not met. Furthermore, considerable experimental evidence has been accumulated in our laboratory as well as in other laboratories which creates considerable reservations concerning the validity, in living cells, of each assumption made by Donnan for his physical systems. This is particularly so for Donnan's assumption (C). The following major topics will be discussed: (1) Does a "Donnan type" membrane exist in most biological cells? (2) Is the existence of a membrane essential for the accumulation and exclusion of electrolytes in living cells? and (3) Are the laws of ideal solutions obeyed in living cells?

Non-Donnan Behavior in Membrane-Damaged Muscle Fibers. M.E. CLARK (San Diego State University)

Donnan theory predicts that whenever an immobile polyelectrolyte system with a net fixed charge is in equilibrium with a solution of mobile electrolytes there will always be a greater concentration of ions within the system, leading to a decreased water activity. If the amount of water required to hydrate the polyelectrolyte and its charge both remain constant, then the amount of water in the system should decrease as ionic strength in the solution is raised, and vice versa. When this model is tested on single muscle fibers of the giant barnacle *Balanus nubilus* which have had their membranes rendered inactive by detergent, exactly the opposite result is observed. Fiber water content increases dramatically with increasing ionic strength. This swelling is accompanied by an increase in net fixed charge. At about 0.6 M salt, the myofilaments lose their normal architecture. When nitrogenous organic solutes, comparable in type and concentration to those naturally present intracellularly in the muscles of all marine invertebrates are added, no swelling is observed at any ionic strength up to 0.6 M, although similar changes in net fixed charge are observed. Fiber architecture remains normal, and the solvent capacity of the water for ions is increased. Thus, Donnan behavior is not the predominant factor determining the degree of cell hydration; instead, salt solvation of myofilament proteins is regulated by organic solutes. NMR experiments show the "excess hydration" water in salt swollen fibers is not "bound" and may represent a region of thermodynamically disordered water between polyelectrolyte surface and bulk water.

Explanation for Apparent Non-osmotic Water in Human Red Cells. A. K. SOLOMON (Harvard Medical School)

When human red cells swell or shrink in response to osmotic pressure gradients, the volume changes are less than those predicted for a perfect osmometer. This phenomenon is discussed fully in the classical literature and is accounted for in terms of "non-osmotic water," which assumes that 20% of human red cell water is unable to serve as solvent water for ions. Since it has been shown that non-ionic solutes such as glucose are distributed in all the human red cell water, it is difficult to understand how so much of the water can discriminate between ionic and non-ionic solutes, notwithstanding the possible spacial properties of water bound to hemoglobin (Hb). Experiments in our laboratory have shown that Hb solutions, just as concentrated, but outside the red cell, do not behave anomalously with respect to the dissolution of salt. Considerations of the simultaneous constraints of osmotic equilibrium and electroneutrality indicate that the red cell osmotic response could be accounted for by considering the net (negative) charge on the Hb molecule to be dependent on cell Hb concentration, decreasing as the cell shrinks. Consequently, cell Cl would enter the cell when it shrinks and vice versa. Cl movement of this kind, unaccompanied by a counter-ion, would obviate the need for the assumption of non-osmotic water. Subsequent experiments have demonstrated net Cl movement which conformed exactly to the theoretical predictions. Thus the evidence that 20% of the human red cell water is non-osmotic is no longer compelling.

Recent Optical Techniques for Monitoring Contractile Dynamics. PAUL PAOLINI (San Diego State University)

Numerous optical methods have recently been applied to the study of striated muscle cell contractility; of particular interest are laser light diffractometry and video micrography. Minicomputer and microprocessor controlled imaging devices (vidicon cameras and linear photodiode arrays) have now been utilized for the real time analysis of twitch contractions in frog semitendinosus fibers and in mammalian isolated cardiac cells.

The individual sarcomeres within chemically dissociated cardiac cells observed under phase contrast microscopy have been "mapped" by computer image analysis. The activation pattern of sarcomeres in these cells is highly Ca^{++} sensitive; shortening appears to originate from a cell end and proceeds in wavelike fashion along the fiber.

Mean sarcomere lengths and percent length dispersions in skeletal fibers have been evaluated from the light diffraction profiles and spacings measured with a fast position-sensitive diffractometer. Fibers exhibit an increase in sarcomere dispersion during relaxation; although length distribution often remains homogeneous, it sometimes separates momentarily into discrete sarcomere populations. Diffraction intensity decreases rapidly upon contraction, then recovers more slowly than tension or sarcomere length. The recovery is particularly prolonged at zero myofilament overlap, suggesting that the line intensity may reflect the degree of randomness in cross-bridge orientation.

Regulation of Force-Generation in Cardiac Myofilaments by Calcium, Crossbridge-Attachment and Magnesium.

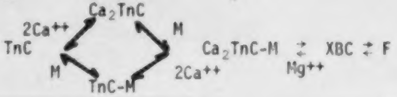
NORMAN BRIGGS (Medical College of Virginia), JOHN SOLARO (University of Cincinnati).

Myofibrillar performance is determined, at a minimum, by the 4 steps shown below.

$$Ca + TnCA \underset{(1)}{\rightleftarrows} CaTnC + M \underset{(2)}{\rightleftarrows} CaTnCAM \underset{(3)}{\rightleftarrows} XBC \underset{(4)}{\rightleftarrows} F$$

where TnC = troponin-C, A = actin, M = myosin, XBC = cross-bridge cycling, F = force.

Examination of the Ca^{++} binding activity of myofilaments and its relation to force generation suggests cooperativity in the binding process which is best explained by assuming that 2 calcium ions must be bound to troponin at step 1. Comparison of calcium binding to IZI filaments and rigor myofibrils indicates that crossbridge attachment influences calcium binding. Thus steps 1 and 2 need to be shown as a branched network. The effects of magnesium on force generation and calcium binding cannot be entirely accounted for by actions on step 1 or 2 and must therefore act on step 3 or 4, most likely 3. These observations suggest that the myofilament force reaction is best represented as shown below.



The Sarcoplasmic Reticulum Membrane: Structure and Function.

G. INESI (University of the Pacific, San Francisco, California).

Sarcoplasmic reticulum (SR) can be isolated from muscle in the form of membrane vesicles retaining Ca^{2+} transport activity as required for control of cytoplasmic Ca^{2+} in the muscle cell. Cation transport is tightly coupled to hydrolysis of ATP, with a reaction mechanism including protein phosphorylation as an intermediate step. Presently, rapid kinetic techniques can resolve the transient state of SR activity yielding forward and reverse constants for most partial reactions. The protein component of SR is quite homogeneous and contains mostly 100000 MW polypeptide chains identified with the ATPase involved in Ca^{2+} transport. Electronmicroscopy and x-ray diffraction indicate that the protein is densely packed on the outer leaflet of the SR vesicles and the chains may be assembled in oligomeric association. Owing to a high degree of specificity the SR vesicles provide a system ideally suited to study molecular mechanisms of ion transport.

Intracellular Calcium Movement and Muscle Contraction.

RICHARD J. PODOLSKY and ELIZABETH W. STEPHENSON (National Institute of Arthritis, Metabolism, and Digestive Diseases, Bethesda, Maryland 20014)

Skeletal muscle cells contain an internal membrane system which consists of (1) invaginations of the outer membrane and (2) the sarcoplasmic reticulum. Stimulation of the outer membrane is conducted by the invaginations to the sarcoplasmic reticulum. The contractile mechanism is activated when calcium contained by the sarcoplasmic reticulum is released into the myofilament space; relaxation occurs when the released calcium is reaccumulated by these membranes. The intracellular calcium level depends on the rates of release and reaccumulation. These processes have been studied quantitatively in skinned muscle fiber preparations, where the outer membrane of the cell was removed by microdissection and the chemical milieu of the myofilament space was controlled directly. Recent experiments suggest that the calcium release and reaccumulation rates both depend on changes in the electrical potential across internal membranes. The release process itself is influenced by the presence of free calcium in the myofilament space, and can be regenerative. The interaction of these processes to produce the physiological activity cycle will be discussed.

Intramembrane Charge Movement and Muscle Contraction.

M. F. SCHNEIDER and P. HOROWICZ (Dept. of Physiol., Univ. Rochester, Rochester, N.Y.).

Intact terminated segments (~500 μm) of single cut semitendinosus fibers (Rana pipiens) were voltage clamped (V_m= -100 mV) at 1-3°C using a single vaseline gap and a circuit which compensated for internal series resistance and current leakage across the gap (Kovács and Schneider, Biophys. J. 17, 5a, 1977). Ionic conductances but not contraction were blocked using (in mM) 75 TEA_2SO_4, 5 Rb_2SO_4 or 5 Cs_2SO_4, 7.5 total $CaSO_4$ and 10^{-7} g/ml TTX externally and 120 Cs glutamate, 2 $MgCl_2$, 0.5 ATP and 1 EGTA internally, both with 5 tris maleate buffer (pH=7.0). On and off current transients for depolarizing pulses carried excess charge, Q_{ON} and Q_{OFF}, above that predicted for the linear capacitance for $-150 < V_m < -100$ mV. For depolarizations up to those moderately above contraction threshold, $Q_{ON}=Q_{OFF}$; for larger depolarization $Q_{ON} \neq Q_{OFF}$, perhaps due to movement artifacts. 100 msec pulses just threshold for contraction (V_m= -44±2 mV) gave $Q_{ON}=Q_{OFF}$ = 9.5±1.0 nC/μF (mean ± S.D.; n=4) normalized to linear fiber capacitance. Different amplitude pulses having durations (9-30 msec) set to produce just threshold contraction moved approximately equal (±10%) amounts of excess charge.

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Some Mathematical Questions in Biology

Arranged by SIMON A. LEVIN (Cornell Univ.)

Tues., 14 Feb. / Shoreham / Board

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Generality and Uniqueness in the History of Life: an Exploration Using Random Models.

STEPHEN JAY GOULD (Harvard University).

Paleontologists have traditionally inferred deterministic causes from apparently ordered patterns in the waxing and waning of diversity during the history of major groups. We (D.M. Raup, T.J.M. Schopf, J.J. Sepkoski, Jr., D.S. Simberloff and I) have generated stochastic evolutionary trees by computer simulation. We "taxonomize" the tree into major groups and plot the history of diversity within these groups through time as conventional paleontological "spindle diagrams." We devise a set of statistics for measuring the sizes and shapes of these diagrams and compute the set of statistics both for randomly generated groups and for actual groups in the fossil record at three taxonomic levels (orders within classes for all of life, families within orders, and genera within families). We have found very little, if anything, in the "real" world that cannot easily be generated (at reasonable probabilities) within the stochastic system. I shall discuss several outstanding correspondences, as well as the few attributes of real systems that may require conventional deterministic causes. At the least, our models act as a "criterion of subtraction" for the recognition of non-random effects. At the most, it may suggest a radical reinterpretation of patterns in the history of life.

Mathematical Optimization Models and Sociobiology.

GEORGE OSTER (University of California, Berkeley).

Optimization models have become one of the principal paradigms in studying evolutionary problems. I will give some examples of how such models can be useful in sociobiology and discuss their limitations.

Towards a Computational Theory of Musical Perception. CHRISTOPHER LONGUET-HIGGINS (University of Sussex).

A computer program has been written which will transcribe a live performance of a classical melody into the equivalent of standard musical notation. It is intended to embody, in computational form, a psychological theory of how Western musicians perceive the rhythmic and tonal relationships between the notes of such melodies.

Some Stochastic Problems in Biology. JOSEPH B. KELLER (Courant Institute of Mathematical Sciences/Stanford Univ.).

Examples of stochastic problems arising in theoretical population genetics and in the theory of carcinogenesis will be presented. Mathematical methods for analyzing these problems will also be described.

Immunological Pattern Formation. PETER H. RICHTER (Max-Planck-Institut für Biophysikalische Chemie).

The immune system is analyzed with particular emphasis on internal connectivity. The virtually omnipotent repertoire of specificities must entail mutual recognition within the system which is assumed to become effective beyond certain thresholds for the concentrations. With regard to its individual antigenic character, the idiotype, an antibody molecule behaves much like an ordinary antigen: it simulates the populations by which it is recognized, the paratypes, and these in turn tend to eliminate the antigen-like stimulus. The details of this relationship are modelled by taking into account a number of well known dichotomies that exist in the immune system: cellular vs. molecular aspect, T vs. B lymphocytes, carrier vs. hapten function. A simple picture emerges which depending on the amount and duration of antigenic challenge, allows for three basic modes of response. The corresponding final patterns of lymphocyte populations are readily correlated to the experimentally defined states of low zone tolerance, normal immunity, and high zone tolerance. Furthermore, heterogeneity in the binding constants of the antigen-antibody association are taken into consideration. As a result, phenomena like maturation during the immune response, original antigenic sin, oscillatory behaviour can easily be understood. The ontogenesis of the self-nonself discrimination can also be described in this framework: low zone tolerance induction as the only possible mode of response in an immature immune system.

Optimal Strategies for an Immune Response. ALAN S. PERELSON (University of California, Los Alamos Scientific Laboratory).

The mechanisms that control antibody secretion, cell proliferation and cell differentiation during a humoral immune response have not yet been elucidated. Hypothesizing that due to strong selection pressure the immune response may have been optimized by natural selection, I compute, using Pontryagin's maximum principle, optimal strategies for the production of plasma cells and memory cells during primary and secondary immune responses. I also examine the switch in antibody class from IgM to IgG from a control theoretic viewpoint. Using a variety of different mathematical models some general strategies for efficient immune functioning emerge. These strategies are compared with experimental results.

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Recombinant DNA, Public Health, and Biomedical Research Policy

Arranged by JONATHAN A. KING (MIT)

Wed., 15 Feb. / Sheraton-Park / South Cotillion

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Issues of Infection, Susceptibility, Virulence and Epidemiology in Recombinant DNA Research. HALSTEF HOLMAN, M.D. (Stanford Univ. Medical School)

Human disease is increasing from micro-organisms normally present in the intestines, respiratory tract and skin, and from other organisms previously considered nonpathogenic. Infections with gram-negative bacteria including E. coli are a rising cause of death. Reasons are presumed to be (1) an aging population, (2) greater prevalence of chronic disease which weakens resistance, and (3) widening use of immunosuppressive drugs. Inadvertant selection for antibiotic resistance may also be involved. Institutionalized persons are particularly susceptible.

Novel recombinant organisms have unknown pathogenic potential and patterns of resistance to antibiotics. Naked DNA can be infectious.

Much rDNA research is conducted in or near medical institutions with contact among research and hospital personnel and patients. Epidemiologic methods to monitor for novel organisms among rDNA workers and their contacts or for rDNA transferred to indigenous organisms, are not well developed.

This situation is largely unprecedented in medicine. It poses significant problems in predicting reliability of containment practices, in monitoring outcomes, and possibly in treating accidental infections. It requires (1) prudence in types, pace, and spread of rDNA research, and (2)informed consent of both persons involved and the surrounding community which is potentially at risk.

The Growing Problem of Antibiotic Resistance. RICHARD NOVICK (Public Health Research Institute of New York City).

A Worker's Perspective on Recombinant DNA and Other Hazardous Biological Research. CLAIRE SULLIVAN (Harvard University).

The heated scientific debate over rDNA has overshadowed substantive issues which are central concerns to laboratory employees directed associated with such experimentation. Among these issues are (1) the need to develop comprehensive educational programs for research, clerical, and maintenance personnel, (2) the need to develop comprehensive health monitoring programs for these personnel, (3) the need to clarify legal responsibility for occupational safety and health of lab workers, and (4) the need for continuous worker participation in the regulation of hazardous biological research.

Employees associated with potentially hazardous research should participate on an informed consent basis. An educational program outlining biohazards and protective protocols should be mandated before a research proposal is approved. Job security for workers choosing not to be involved in a research program must be assured.

Current systems for monitoring the health of lab personnel and the effectiveness of containment are inadequate. Occupational health and safety programs geared to the special needs of lab workers should be accomplished prior to the proliferation of hazardous research.

Enforcing and developing guidelines for safe practice requires full employee involvement. Worker representation through their unions, or through organized worker safety committees should be required by legislation, if Biohazard committees are to truly perform their regulatory function.

The Protection of Workers from Industrail Hazards. ANTHONY MAZZOCCHI (Oil, Chemical, and Atomic Workers Union, Washington, D.C.).

Ethics and Recombinant DNA Research. SISTER ANN NEALE, GNSH (U.S. Catholic Conference, Bishops' Committee for Human Values).

What, if anything, can philosophers/ethicians/theologians contribute to the recombinant DNA controversy? Do they define the issue/s as does the scientific community? Are there limits to what microbiologists and public health officials qua microbiologists and public health officials can contribute to policy questions? What can normative ethics add to the recombinant DNA dialogue? What can recombinant DNA techniques tell us about the adequacy of the categories and norms of traditional ethics? Such questions will be considered in an attempt to deal with the matter of duties and rights surrounding recombinant DNA techniques. The numerous, complex issues raised by this development should be dealt with ethically and by principles and not merely by the pressure of interests.

Scientific Innovation versus Environmental Protection. FRANCINE SIMRING (National Coalition for Responsible Genetic Research, New York, N.Y.).

The Legislative Problem. RICHARD OTTINGER (US House of Representatives, D-N.Y.).

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A Cold Look at the Warm-Blooded Dinosaurs

Arranged by ROGER D. K. THOMAS (Franklin and Marshall College, Lancaster, PA)

Thurs., 16 Feb. / Sheraton-Park / North Cotillion

3:00 p.m.-6:00 p.m.

The Evidence for Endothermy in Dinosaurs. JOHN H. OSTROM (Peabody Museum of Natural History, Yale University).

Several different and seemingly independent lines of evidence have been represented, by various authors, as indications of internal temperature regulation and high exercise metabolism in dinosaurs. These convergent conclusions are based on evidence of posture and gait, bone histology, the inferred trophic dynamics of dinosaurian communities, and the geographic, latitudinal distribution of dinosaurs. These arguments will be reviewed and evaluated. Critics of the hypothesis that dinosaurs were endothermic have correctly pointed out that much of the supposed evidence can be explained in other ways. However, these other explanations do not argue against the hypothesis of warm blood; they are simply alternate, also viable explanations of the individual lines of evidence. The anatomical variety of animals called dinosaurs is very wide. It follows that they may have differed equally widely in their modes of temperature-regulation and metabolism. It is rarely mentioned that not all of the evidence for endothermy applies to all kinds of dinosaurs. In fact, only one dinosaurian group - the Theropoda - exhibits all the kinds of evidence marshalled by the advocates of warm blood. The probability that birds are direct descendants of theropods adds an intriguing dimension to the subject. At the moment, the evidence is highly suggestive, but as yet still inconclusive.

Dinosaur Trophic Dynamics, Population Structure and Physiology. ROBERT T. BAKKER (Johns Hopkins University).

If dinosaurs were ectothermic, merely "good reptiles," then their success presents an extraordinary paradox. For the last 65 million years, the great majority of large land vertebrates have been automatic endotherms. The superiority of birds and advanced mammals is surely based on their ability to maintain high, relatively constant body temperatures. Appearing in the fossil record at about the same time, dinosaurs radiated rapidly to dominate land faunas while mammals were long restricted to very small sizes. Only after the extinction of the dinosaurs did mammals produce a radiation of large species. How could dinosaurs, merely "good reptiles," outcompete mammals for so long? Two quantitative palaeobioassays, calibrated by comparisons between groups of known bioenergetic levels , record endothermy in extinct vertebrates. Tertiary mammals can be assumed to have been automatic endotherms; very primitive reptiles of the Early Permian were certainly ectotherms. Bone histology of large mammals shows dense capillaries and frequent development of close-packed haversian systems; large living and Early Permian reptiles show much less dense capillaries and haversian systems. The mean ratio of predator biomass to prey biomass in large mammal communities is from 1 to 3%; the mean ratio for living and Early Permian ectothermic communities is from 20 to 50%. The range of dinosaur histologic types is entirely within that of mammals; dinosaur predator/prey ratios are indistinguishable from those of mammals. These assays leave no room for equivocation: dinosaurs were automatic endotherms.

The Parietal-Pineal Complex Among Paleovertebrates: Evidence for Endothermy. JAN J. ROTH (Laboratory of Brain Evolution and Behavior, NIMH).

Classically, reptiles were thought to lack any precise means of endogenous temperature control, being regarded, inclusively, as cold-blooded poikilotherms or, more recently, as ectotherms. Dependent upon external heat sources for the activation of physiological processes, they have been considered subject to the vicissitudes of seasonal and climatic temperature fluctuations. However, some living reptiles are capable of precise temperature regulation. When active, many lizards regulate their body temperatures as precisely within a narrow range as do mammals around a specific set-point. Recent evidence clearly indicates that the parietal-pineal complex, a neuro-endocrine component of the central nervous system, is responsible for the control of body temperature in some reptiles. The pineal gland proper affects thermal homeostasis among birds and mammals. The fossil record suggests that the morphological association between the extracranial parietal eye and the intracranial pineal body goes back to the Ordovician and the class Agnatha. If the occurrence of these structures reflects thermal physiology, paleovertebrates can be assigned to ectothermic or endothermic categories, based upon the gradual elimination of the parietal eye as endothermy became established. The results correlate well with established physiological and taxonomic models, except for Archosauria. The dinosaurs seem to have developed a thermal physiology quite different from those of existing ectothermic and endothermic groups.

Behavioral Thermoregulation in Living Reptiles. NEIL GREENBERG (Laboratory of Brain Evolution and Behavior, NIMH).

Ectothermic, behavioral and endothermic, physiological mechanisms for the regulation of body temperature are viewed as points on a continuum. The thermoregulatory strategies adopted by individual species are regarded as complex adaptations, not compromises imposed by behavioral and ecological limitations. Behavioral thermoregulation will be defined and the diversity of strategies employed by living reptiles, as elucidated in the field and laboratory, will be reviewed. The principal strategies employed, including adjustments of posture and microhabitat selection, are related to both individual experience and evolutionary history. The postulated functions of thermoregulation will be discussed in the context of its relation to other patterns of behavior, such as arousal, general activity, feeding and social interactions. The thermal ecology of large living reptiles and the transition from principally behavioral to principally physiological means of thermoregulation among the living higher vertebrates provide critical comparative data for the analysis of dinosaur physiology.

Thermoregulation in Dinosaurs: Point and Counterpoint. NICHOLAS HOTTON (Smithsonian Institution).

The traditional treatment of dinosaurs as ectotherms is inconsistent with their anatomical similarity to birds and the level of activity of which they were apparently capable. This inconsistency has persisted in part because of the fundamental, parsimonious assumption that ectothermy and poikilothermy preceded endothermy and homoiothermy in vertebrate evolution. New evidence from living vertebrates suggests that ectothermy and endothermy represent divergent adaptive strategies as much or more than they represent archaic and progressive conditions. It is argued that the dominant thermoregulatory strategy of dinosaurs was related to size. In the context of presumed equable Mesozoic climates, this hypothesis is able to account for all the other morphological features from which dinosaurs are adduced to have attained an avian or mammalian mode of endothermy. Dinosaurs did indeed evolve functional homoiothermy and perhaps endothermic temperature regulation adequate for Mesozoic conditions, which, in their size range, enabled them to compete successfully against potential rivals for 130 million years. However, their thermoregulatory strategy was different from those of birds and mammals and had different constraints and consequences.

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Biological Transformations of Inorganic Nitrogen

Arranged by WILBUR H. CAMPBELL (State Univ. of New York College of Environmental Science and Forestry, Syracuse)

Fri., 17 Feb. / Sheraton-Park / Dover

9:00 a.m.-12:00 m.

Nitrogen Fixation to Meet Nitrogen Needs of Crops. R. W. F. HARDY (Central Research & Development Department, E. I. du Pont de Nemours & Co., Wilmington, DE 19898).

An estimated doubled world demand for cereal grain and a quadrupled one for grain legumes by 2000 AD will in turn create a demand for an additional 75-100 million tons/year of fixed nitrogen. This nitrogen will be provided by biological and/or abiological fixation of the abundant atmospheric N_2. It is desirable but not necessary to develop alternate technologies for provision of this fixed nitrogen. The unprecedented wealth of technical information on N_2 fixation at the chemical, biochemical, genetic, physiological, agronomic, and ecological levels is enabling the identification of constraints as well as opportunities for improved or new technologies for N_2 fixation. These technologies may include abiological systems, legume-rhizobial systems, systems for nonlegumes, and even more speculative systems. The demand for fixed nitrogen will be so large and the cropping systems so diverse so as to make a variety rather than a single technology desirable.

Assimilation of Nitrate by Soil-Plant Systems. Wilbur H. Campbell (SUNY College of Environmental Science and Forestry, Syracuse, N. Y.).

The reduction of nitrate to ammonia is the major pathway for entry of nitrogen into the food chain. A wide variety of organisms, including bacteria, fungi, algae, and higher plants, are able to assimilate nitrate for growth. The assimilation of nitrate occurs in steps with catalysts identified at each stage. Initially, nitrate is reduced to nitrite by nitrate reductase, a molybdenum containing enzyme. Nitrate reductase has proven difficult to purify and, therefore, the biochemistry of this complex protein has been throughly studied in only a few organisms. Nitrite reduction to ammonia is catalyzed by nitrite reductase, an enzyme which contains siro-heme (an iron prophyrin) and iron-sulfur centers. The nitrite reductase of higher plants has been shown to be in the chloroplasts and to be dependent on light energy via reduced ferrodoxin. Ammonia is incorporated as the amide group of glutamine via glutamine synthetase, a chloroplastic enzyme which utilizes ATP. The amide nitogen enters the mainstream of available reduced nitrogen by transfer to 2-oxoglutarate to form glutamate in a reductant dependent reaction. Finally, the reduced amino nitrogen can be transferred to a proper carbon skeleton for synthesis of amino acids and the amino acids can be utilized for the synthesis of proteins.

Denitrification. W. J. PAYNE (University of Georgia, Athens).

Much of the N of NO_3^- fertilizer is driven out of agricultural soil by denitrification (DNF) that takes place just below the surface before crop plants have the opportunity to assimilate NO_3^-. DNF is anaerobic respiration exhibited by several ordinarily aerobic bacterial species - but no other living forms. NO_3^-, NO_2^- or N_2O can replace O_2 and are reduced in order ($NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2$). N_2 is the end product for most denitrifiers, but some N_2O is also released into the earth's atmosphere. Most denitrifiers, such as the Pseudomonas species that predominate in soil, fresh and marine water, and marshes, catabolize organic compounds. The chemolithotrophic Thiobacillus denitrificans oxidizes reduced sulfur compounds. Electrons move along ordinary transport chains initially, but specialized cytochromes link terminal steps in reduction of the N-oxides. A molybdoprotein catalyzes reduction of NO_3^- at the expense of reduced b-type cytochrome. NO_2^- accumulates transiently and is then rapidly reduced by specific coupling with a reduced c-d-type cytochrome. The NO generated forms a heme-NO complex and is reduced to N_2O. A cytochrome with absorption maxima at 542 and 573 nm in the presence of NO is specifically involved in enzymatic NO reduction. In natural populations or in whole-cell experiments, NO is released only under adverse conditions (such as an acid pH). N_2O normally accumulates transiently. Activity but not synthesis of N_2O reductase is inhibited selectively by acetylene. In soil or water systems, this agent permits quantitative assay of N_2O rather than N_2 to indicate DNF. Annual rate of loss of N_2 to DNF is unknown but thought to be slightly less than the quantity fixed.

Nitrification by Soil Microorganisms. E. L. SCHMIDT (University of Minnesota).

Refractory to ready culture, difficult to isolate, and of nondescript morphology by light microscopy, the nitrifying bacteria function in complex habitats to carry out a process of great practical importance. In order to understand, interpret, and model the process there is need for microbiological information on two basic aspects: the diversity of the nitrifiers, and their activity in nitrifying environments. The usual approach, using most probable number (MPN) techniques, has been uninformative, but recent application of immunofluorescence (FA) has provided some insight into these basic concepts. MPN and FA enumeration agreed when applied to a pure culture, but the precision of the MPN was only about one-fifth that of the FA. Estimates of nitrifying populations in soils were 1 to 2 or more logs higher by FA. Serological data indicate a previously unrecognized diversity among ammonia oxidizers. The three genera of ammonia oxidizers, Nitrosomonas, Nitrosolobus, and Nitrosospira appear to be common in soil and widely distributed; each has multiple serotypes. Combined MPN and FA study of this diversity demonstrated clearly the selectivity of MPN media as a major factor in MPN underestimation of nitrifying populations. Evidence contrary to accepted views that tannins and rhizospheres inhibit nitrifiers will be presented.

Meeting World Nitrogen Needs--Problems and Perspectives. JAMES M. TIEDJE (Michigan State University).

The nitrogen cycle will be reviewed with regard to the problems and potentials for each component as it affects primary productivity. Some of the typics to be discussed in regard to future research needs are: the impact of fertilizer on the stratosphere, the under-exploited tropical legumes, Rhizobium competition and survival, N-ion membrane transport, soil-water-microbe management to improve efficiency of nitrogen use, N-fertility concerns associated with the potential increased production of plant biomass for energy and chemical industry feedstocks, and methodological advances and barriers to meeting N research needs. Special emphasis will be placed on the ecological factors which control the success of particular microbes in nature and what information is necessary if one hopes to modify the native microbiota for the benefit of man. Also to be emphasized is the need for the integration of fundamental and applied efforts together with realism in order to achieve meaningful advances for society.

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Threatened and Endangered Species

Arranged by DONALD J. ZINN (Natl. Wildlife Federation)

Fri., 17 Feb. / Sheraton-Park / Dover

3:00 p.m.-6:00 p.m.

Present and Future Government Legislation Necessary to Support Endangered Species Conservation. MICHAEL E. BERGER (National Wildlife Federation, Washington, D.C.).

Progress Report on U.S.-International Efforts to Conserve Threatened and Endangered Species. PATSY T. MINK (U.S. Department of State).

Plant Endangerment and Ecological Stability. RICHARD W. DYER (U.S. Fish and Wildlife Service, Newton Corner, Mass.).

NEPA and the Economics of Endangered Species Conservation. CHARLES WARREN (Council of Environmental Quality, Washington, D.C.).

The Conservation and Management of Threatened and Endangered Species. JOHN SPINK (Office of Endangered Species, U.S. Fish and Wildlife Service, Washington, D.C.).

8. AGRICULTURE AND FOOD

Nutrition and Agriculture: Strategies for Latin America

Arranged by TERESA SALAZAR DE BUCKLE (Instituto de Investigaciones Tecnologica, Bogotá, Colombia) and JOEL BERNSTEIN (NAS)

Mon., 13 Feb. / Sheraton-Park / Madison

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Tues., 14 Feb. / Sheraton-Park / Madison

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

World Food and Nutrition Study: Promises and Prospects D. GALE JOHNSON (Eliakim Hastings Moore Distinguished Service Prof. of Econ., Univ. of Chicago)

The paper will include a brief summary of the major conclusions of the U.S. National Academy of Sciences' World Food and Nutrition Study. Included will be the assessment of the world food and nutrtion situation currently and alternatives for the future, the major research areas that hold the greatest promise for improving food and nutrition and how the needed tasks can be undertaken. Emphasis will be given to the potential role of the social sciences in facilitating the adjustments that will be required if the existing potentials for improving nutrtion are to be realized. The role of national and trade policies of both the industrial and developing countries in influencing future developments will be highlighted and some critical comments made about recent and current policies in both groups of countries. The recent declines in many food prices, especially the grains and sugar, may well make it difficult to mobilize the resources required to achieve a significant improvement in the nutrition status of the poorer peoples of the world. Low prices of grains in the international markets and substantial transfers of food as aid will contribute very little to improving nutrition and incomes in the developing countries.

The Future Role of Agricultural Research for Food Production: Strategies in the Humid Tropics of Mexico. EDUARDO ALVAREZ LUNA (Instituto Nacional de Investigaciones Agrícolas), RODOLFO MORENO DAHME (Instituto Nacional de Investigaciones Agrícolas).

The urgent need to obtain through an intensification of present day agricultural research programs a more complete knowledge of the extension, geographical distribution and the adverse soil physical and chemical characteristics that are at present limiting the yields harvested per hectare on the different types of latosolic soils prevalent in the Humid Tropics of Southern Mexico, is discussed. Future plant Nutrition studies must place special emphasis on the evaluation of the availability and degree of assimiliation of sulphur and minor elements, in addition to the usual evaluations of available nitrogen, phosphorus and potassium. Experimentation must establish the need and profitability of liming and determine specific crop requirements, when used in combination with adequate soil management and the use of chemical fertilizers, to prevent the rapid decline of soil productivity usually occurring in these humid tropical soils. Simultaneously Crop-breeding work to obtain new varieties of regional crops that prosper in Southern Mexico, that possess the ability to produce higher yields per hectare, due to their low phosphorus requirements or their superior ability to extract phosphorus and/or minor elements from soils that contain relatively low levels of available forms of these plant nutrients, must be pushed very actively, in order that the best food production strategies for the region can be solidly planned and carried out successfully.

Ideas for Improving the Content and Process of Technology Development, Adaptation, and Diffusion in Latin America. MARTIN PIÑEIRO (Instituto Interamericano de Ciencias Agricolas, Bogotá, Colombia).

Blaming the Victim: Small Farmer Production in an Amazon Colonization Program. CHARLES H. WOOD (Center for Latin American Studies, University of Florida, Gainesville) and MARIANNE SCHMINK (University of Texas, Austin).

A Case Study of a Vertically Integrated U.S. Feed Company. EDWARD PASTUCHA (International Primary Service, Ltd./Agrobusiness Council, New York, N.Y.).

Comparative Cases of Vertically Integrated Operations in Agroindustry: Mexico, Venezuela, Colombia, Peru, Argentina. ALEXANDER GROBMAN (Dep. Dir., Centro Internacional de Agricultura Tropical, Palmira, Colombia)

This paper presents a multi-country analysis of vertically integrated food industry operations, on the basis of the author's experience over the last ten years in Mexico, Venezuela, Colombia, Peru, and Argentina. The industrial vertical integration (farm to market) has the peculiarity of being made up of enterprises not perfectly integrated, but fully "coordinated" in terms of complementary or joint interests and aims. These are are: seeds, feed, and poultry. The time span to be covered is 1966-1976. The "research base" was the discovery of cytoplamic male sterility in sorghum. The application was the quick awareness of U.S. seed companies of the economic implications of the discovery, in view of the fact of the unique "applied research" information from a private-public joint or separate network of tests which proved the amazing fact (unique in agronomy) of the existnce of a low genotype environment interaction for yield in sorghum, as measured by grain weight/hectare/day/m^3 of water —either rainfed or irrigation fed. The complementaries in the system were: a) the use of hybrid layer hens or broilers in the production system coupled with efficient pest control chemicals and advanced feed technology; b) the advent of computerization in feed formulation; c) the advanced technologies of soybean/soybean meal production and anchovie/fish meal preparation. The addition of sorghum grain production in these countries may exceed that of the rice or wheat added productions due to their technologies.

A Case Study of the Peruvian Agroindustry Experience. JUAN SALA (Latin American Projects, Merck, Sharpe & Dohme International).

Integration of Nutrition Planning and Development Planning: The Colombian Experience. TOMAS URIBE (Programa Nacional de Alimentación y Nutrición de Colombia, Bogotá).

Asian Cases: Improved Health and Nutrition Despite Low per capita GNP. DAVID GWATKIN (Overseas Development Council, Washington, D.C.).

The NAS World Food and Nutrition Study: Directions for Incorporating Nutrition Considerations in Planning. SOL H. CHAFKIN (Ford Foundation, New York, N.Y.).

Overcoming Constraints to Achieving Nutrition Goals Through Development Planning. MARTIN FORMAN (A.I.D., U.S. Department of State).

Nutrition and Development: The Case of Chile. GIORGIO SOLIMANO, M.D. (Institute of Human Nutrition, Columbia Univ.), PETER HAKIM (The Ford Foundation).

This study is a historical analysis of the relationship between malnutrition and development in Chile. It emphasizes the influence of political and economic factors on nutritional standards. The paper shows first the marked and persistent inequalities in food consumption, growth rates, and survival chances that have existed in the country's different socioeconomic strata since the 1930s, and concludes that these inequalities increased over time. Evidence is presented which indicates, although does not confirm, that the diets of the lowest income groups probably did not improve between 1935 and 1970. The paper examines the country's pattern of development in the same period by discussing its industrial, agricultural and social sectors. Since Chile experienced considerable economic growth, more than doubling per capita income, and becoming a semi-industrialized country, the study questions the conventional view that national economic advancement will inevitably lead to improvements in nutritional standards. Moreover, since Chile boasted one of the most progressive records of social legislation among developing societies, the study further suggests that malnutrition is not likely to be significantly reduced in the third world countries in the forseeable future without rather drastic changes in political and social organization.

Agricultural Research Collaboration in the Southern Cone. VICTOR HORCASITAS (Project Analysis Department, Inter-American Development Bank, Washington, D.C.)

Self-Help for the Alleviation of Malnutrition Problems in Latin America through Utilization of Local Appropriate Food Technology. BEN F. BUCHANAN (Santa Rosa, California).

An 18-month study funded by U.S. Agency for International Development was conducted by the Institute of Food Technologists to help find ways in which Latin American food technological resources could be used to alleviate malnutrition problems prevalent in those countries. The study was designed to assess the food technology resources in Latin America, to identify the reasons malnutrition exists in the target population (pre-school children and lactating or pregnant women) and which are amenable to food technological solution, to identify constraints which have prevented or deterred local food technology resources from being more effective in a solution of these problems, to suggest action programs which would overcome these constraints, and to design one or more pilot projects in specific areas to test the feasibility of the suggested action programs. This study was unique in that the Latin Americans themselves catalogued their resources, identified the problems suggested action programs, and designed the pilot projects. Although the project proposals require that the actual detail activities be carried out by local Latin Americans each carries a provision for consultative assistance from North American specialists. This study demonstrates Latin American capabilities and willingness to cope with their own malnutrition problems through the application of available local technologies. Of greatest need is a stimulus, some advisory guidance, and funding for proposed projects clearly identified by them.

Bilateral Programs of the National Academy of Sciences (USA) in Latin America. HARRISON BROWN (Resources Systems Institute, East-West Center), THERESA TELLEZ BROWN.

For the past twelve years the National Academy of Sciences has sponsored a series of bilateral programs in Latin America in collaboration with national science organizations in Peru, Chile, Argentina, Brazil, Colombia, Guyana and Guatemala. The objectives of the programs have been to provide mechanisms to enable scientists from the United States to work closely with their counterparts in Latin American countries on projects aimed at strengthening Latin American research and development capabilities. The programs varied considerably in their effectiveness. Comparative examination of the programs suggests several criteria for success. On the basis of these earlier experiences several suggestions are presented for future development of bilateral scientific and technological collaboration as applied to food and nutrition problems.

International Collaboration: The Inter-American Center for Tropical Agriculture and the Latin American Countries. PETER R. JENNINGS (Rockefeller Foundation).

Bilateral R&D Collaboration between a U.S. University and Latin American Agencies. JACKSON A. RIGNEY (Dean, Internat. Prog., N.C. State Univ., Raleigh).

An analytical review of the experience of N.C. State University in collaborative research and development activities in several Latin American countries provides lessons and guidelines for future activities. The lessons learned are fundamental to the success or failure of the bi-lateral R&D effort. They are: 1) Collaborative efforts in international R&D can only be effective if the motivating goals of each party are articulated clearly and openly. 2) An effective strategy must include the appropriate balance between producing research and development products per se versus development of institutional capacity to perform these functions in the future. 3) An effective strategy must provide for developing an early and continuing broad base of political support for the institutions involved. This must come from users who benefit from the products as well as from the national planners and policy makers. The developmentof such support is crucial to the longevity and effectiveness of the total enterprise. 4) Research is a long-term process that requires a considerable exercise of faith on the part of those who invest in it, but strategies in planning research programs must include the probability of a few early results that can be used to nurture investor and public support. 5) Research is primarily a product of the mind, and wise management of research personnel will strive to stimulate and motivate rather than control. This is essential to the productivity in research and development.
6) Rewards for outstanding performance in R&D must be designed to keep professionals active in research and development rather than moving them to remote administrative positions. 7) R&D efforts must be directed to activities in high priority areas that have high probability for success rather than in exotic schemes which attract newspaper headlines but seldom pay off in rural development. 8) Frequent reorganization of the participating institutions or redirection of priorities by funding agencies guarantees low level of performance and efficiency. 9) The linkages between research and development must be strong and effective and must provide for two-way low of communication. 10) The relationship between collaborators must be sensitive to the increasing competence on the part of host national scientists. The role played by U.S. collaborators must change subtly but certainly to a truly peer relationship as host nationals gain competence and confidence.

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Food Production and Energy: Present Status and Future Alternatives

Arranged by BILL A. STOUT (Michigan State Univ.)

Tues., 14 Feb. / Sheraton-Park/ Richmond

9:00 a.m.-12:00 m.

Why Farmers Use Energy As They Do: Future Options and Implications. BRUCE A. MCKENZIE (Purdue University).

Discussion will focus initially on current farm practices from a production goal and energy use viewpoint and consider the basis for the current technology. Current practices will then be viewed in terms of past and future alternatives and methods to develop perspective on future technology options and factors that will influence their adoption.

Agriculture's Energy Needs: Current and Projections. EARLE E. GAVETT (USDA, Economic Research Service).

The 1974 data base on crop and livestock production and energy requirements serves as the base for projecting energy needs in agriculture to 1980, 1985 and 1990. Factors affecting agricultural energy demand are considered including: domestic population and its demand for food, export demand for farm products, and the continuation of present trends in farming practices. The present trend scenario includes a continuation of the shift to dieselization of major farm powered equipment, increased use of reduced tillage practices with more chemical pest control, higher fertilizer application rates, and adoption of sound energy conservation practices. Using normalized yields and the trend to greater yields per acre, fewer acres of cropland will be needed through 1990 than in 1974, but farm output will be 30 percent greater. Total energy requirements will be only slightly greater in 1990 than at present, but there are sharp differences in the amounts of the different types of fuels needed.

Energy Resources and Forage Production. G. H. HEICHEL (Agricultural Research Service, USDA and The University of Minnesota).

Approximately 54% of U.S. animal feed is derived from forage crops, and a heavier reliance of animal nutrition on forages is forecast for the future. Leguminous forages are also being tested as sources of protein for direct human consumption. Despite the current and future importance of forage crops in assuring abundant and nutritious food, little attention has been given to the energetics of forage production in U.S. agriculture. When they are grown in rotational cropping systems, leguminous forages contribute nitrogen to succeeding crops, thus effecting a potential savings of energy resources otherwise needed for fertilizer manufacture. Substitution of forage for coarse grains in animal rations may allow ruminant animals to be raised with fewer demands on scarce energy resources. When compared with horticultural and vegetable crops, forage crops are among the most energy frugal. Thus, forages may have a hitherto unappreciated role in reducing the vulnerability of U.S. agricultural production systems to increased energy prices. In this paper, the energetics of producing forages are exemplified to illustrate how production methods influence the productivity of the crop and the efficiency of using energy resources. I also illustrate the energy credits that accrue to cropping systems when leguminous forages are components of rotations.

Assessing the Fuels and Engines of Tomorrow's Agriculture. WILLIAM C. BURROWS (Deere and Company).

Most agricultural equipment is expected to have a useful life of between 20 and 25 years. This means that the machines produced today will be expected to do useful work in the year 2002. Each day that passes takes this time further past the turn of the century - and further to the time when petroleum-based fuels may not be available at any cost. We have examined alternative engines and alternative fuels for applications in the future agricultural machines. Our general conclusion is that, with the conversion of coal to liquid fuel, future agricultural machinery may be expected to be powered by diesel engines running on diesel fuel for a significant period after 2000. The greatest problems do not appear to be technological, instead economics and politics - as well as environmental quality - are the great unknowns.

Energy Use in Agriculture: Now and In the Future. BILL A. STOUT (Michigan State University).

The Council for Agricultural Science and Technology organized a 22 man task force to analyze energy use in agriculture. The findings of the CAST task force will be summarized.

Questions that will be addressed include:
-- Why and how is energy used in agriculture?
-- Should we return to a more labor intensive agriculture?
-- What substitutions for petroleum and LP gas are feasible?
-- Why use fertilizers?
-- What fertilizer options are available?
-- Why should we tolerate the inefficiencies of animal agriculture?
-- What is the potential for biomass as a fuel?

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Future Production and Consumption of Meat

Arranged by CLAIR E. TERRILL (U.S. Dept. of Agriculture, Beltsville, MD)

Wed., 15 Feb. / Sheraton-Park / Dover

9:00 a.m.-12:00 m.

Livestock Efficiency for Meat Production Without Grain. C.W. COOK (Colorado State University, Ft. Collins, Colo.)

The efficiency of energy utilization by animals in range ecosystems is based upon the maintenance and production of animal biomass that can be exported from the system on a sustained yield basis rather than the conventional weight gain of an individual animal per unit of energy consumed. Efficiency can be increased by better ecosystem management resulting in higher energy conversion and transfer in the system. Rabbits are one of the most efficient meat producing herbivores in biological systems. Goats and sheep are more efficient than cattle but all three can be used effectively in harvesting the forage resource. This is a result of the varying tolerances of each species to weather, insects, and disease and because more than one species of animal on the range uses the forage resource more uniformly as a result of varying topography, available water and preference for different plant species and portions of plants. Fossil fuel expended for range meat and fiber production is considerably less than that required of other feeding systems. Complementing rangelands with dryland forages and crop aftermath offers great promise in reducing the need for fossil fuel in producing meat protein for human consumption.

Genetic Improvement of Livestock for Efficiency of Meat Production. GORDON E. DICKERSON (U.S. Meat Animal Research Center, Agricultural Research Service, U.S. Department of Agriculture).

Potential further genetic improvement in the net input/output efficiency of cattle, sheep, goats, swine and poultry in meat production is examined. Limits and possible rates of improvement for each species are estimated from genetic variability in major physiological components of animal performance and their effects on costs and composition of meat production. Costs for reproducing females are affected by such components as age at puberty, fertility, litter size born, viability of young, inter-partum interval, body size, composition, metabolic rate and milk production. Costs for growing young vary with rate and composition of growth and slightly with basal metabolism and efficiency of tissue synthesis. Short-term improvement derives from exploitation of genetic diversity among existing stocks within species by strategic crossbreeding. Long-term improvements are maximized by optimum selection emphasis on components. Reduced availability or increased costs of feed grains will handicap improvement in non-ruminant meat production but will limit volume of ruminant meat production as well.

Value of Meat as Human Food. P. V. J. HEGARTY (University of Minnesota).

The human has evolved as an omnivorous animal with a tooth formation that is of an all purpose variety, and with a comparatively unspecialized alimentary tract. Therefore, meat is a natural component of the human diet. Meat, including the organ meats, is high in protein, B Complex vitamins especially thiamin, riboflavin and vitamin B_{12}, vitamin A, iron and zinc. The biological availability to the human of both the iron and zinc in meat is greater than in other foods because of the lack of interfering compounds in meat. The protein is of a high nutritional quality, and in a highly concentrated form. It is wrong to discuss the nutrient content of meat in generalities because these may vary in cuts from different species, or to the genetic background of the animal or to the method of cooking. For example, there is less fat but of a higher polyunsaturated to saturated fatty acid ratio (P/S) in meat from non-domesticated animals compared to meat from domestic animals. The low

P/S ratio is considered by some researchers to be detrimental with respect to coronary heart disease (CHD). The P/S ratio can be raised by altering the animal's diet, but this may be impractical because of sensory and economic factors. The long term health consequences to the human of a high P/S ratio diet should be studied in detail not only with respect to CHD, but to other diseases such as cancer. There is limited evidence linking a high P/S ratio with increased cancer mortality. The synthesis of observations implicating diets high in fat, and in beef in particular, to a theory of carcinogenesis at this time is speculative according to authorities in this area.

Are Residues in Meat A Significant Problem?

Thomas H. Jukes, Univ. of California, Berkeley.

Meat can contain residues of non-nutritional substances that are present in the food of animals. Such substances occur almost always in concentrations far below toxic levels. They include toxicants occurring naturally in foods, such as aflatoxins, plant estrogens and goitrogens. Except for aflatoxin, these substances are commonly ignored. Accidental contaminants include polybrominated biphenyls (PBB), a local problem mainly in Michigan. Bacterial toxins can be formed in meat as a result of spoilage. Pesticide residues, when present, are usually not in biologically significant amounts, because of the extensive regulations and monitoring associated with the use of pesticides. Residues of DES, antibiotics and other medications are kept within tolerable levels by withdrawal procedures. In general, the excretory and metabolic functions of meat animals serve to "filter out" substances that might otherwise reach the consumer. DES is an excellent example; it is rapidly conjugated and excreted in the urine and bile of cattle. Some antibiotics used in feeds, such as penicillin and bacitracin, are not found in meat because they are destroyed by intestinal bacteria, or do not leave the intestine. Others, such as the tetracyclines, are destroyed by cooking, or disappear following withdrawal periods, and no effects on consumers from antibiotics present in meat are on record. Other medications used in meat production are also adequately controlled by withdrawal periods. The main problem with meat is bacterial contamination that causes food poisoning, but this is much rarer in the U.S.A. than in most other countries.

Utilization of Saturated and Unsaturated Fats and Cholesterol Diets.

RAYMOND REISER, Texas A&M University, College Station

The recommendation of the American Heart Association, repeated by the U.S. Senate Select Committee on Nutrition and Human Needs in Dietary Goals for the United States that poultry and fish be substituted for red meat, cannot meet the objective of the recommendation; to reduce cholesterol intake to 300 mg. per day. The substitution is futile since chicken has more cholesterol than beef or pork, and fish has no less. The cholesterol content of flesh varies inversely as the fat content. The only saturated fat that has been shown to increase serum cholesterol in the absence of cholesterol is coconut oil. The P/S ratio concept is not valid except in the presence of considerable amounts of cholesterol. Even then, the effect is physiologically insignificant. It makes little difference how much cholesterol is in meat, poultry or fish since 70% to 80% of the population maintain normal- that is non atherogenic- levels of serum lipids regardless of their cholesterol intake. Of the remaining 30%, many have pathogenic levels even on low levels of cholesterol ingestion. The concept that risk of coronary heart disease is directly related to serum cholesterol concentration at all levels is invalid.

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The Question of Meat

Arranged by ALEX HERSHAFT (Interstate Electronics Corp., Arlington, VA)

Wed., 15 Feb. / Sheraton-Park / Dover

3:00 p.m.-6:00 p.m.

The Nutrition and Health Case for Meat Consumption.

GEORGE V. MANN (Vanderbilt University).

The role of meat in the diet as a factor in health will be debated. The affirmative position, that meat makes an important contribution to dietary adequacy and health will be documented. The hypotheses relating consumption of meat to coronary heart disease and colon cancer will be disproven. The alleged noxious effects of meat additives will be discussed and shown unjustified. The unique nutritional advantages of meat will be reviewed and the role of ruminants as energy retrievers will be examined.

The Nutrition and Health Case Against Meat Consumption.

JOHN A. SCHARFFENBERG, M.D. (Loma Linda University)

A summarization of the facts relating meat consumption to nutritional and health status will be given. This will include a review of the Inter-Society Commission for Heart Disease Resources report and the Senate Select Committee on Nutrition and Human Needs' "Dietary Goals for the United States." Evidence will be presented relating diet to atherosclerosis, cancer, and other disease states, such as trichinosis and salmonellosis. Data on longevity and life expectancy decrements from flesh diets and the possible reasons for this will be pointed out. Meat inspection is of little value in the prevention of the harmful effects of the flesh diet. A higher carbohydrate diet, as in the non-flesh diet, has been shown to increase endurance. Due to the fact that animals are poor converters of calories, meat cannot be recommended in those areas of the world that are highly populated. Not only is energy for human consumption lost, but so is protein when populations subsist on an animal diet. Flesh foods yield less nutrition for the dollar than non-flesh foods. Due to the great population explosion, present recommendations call for a non-flesh diet in many areas of the world.

The Economic and Ethical Case for Meat Consumption.

RICHARD E. LYNG (American Meat Institute).

With $35 billion in annual sales, the meat industry represents an important sector of the U.S. economy. It also supplies raw materials to the apparel, cosmetic, and drug industries. Use of animals for food permits the utilization of surplus grains as well as grasslands and other marginal lands not suitable for growing of grain crops. The first part of the presentation will explore these economic issues and will show that a substantial reduction in meat consumption would have serious consequences for the U.S. economy. The second part of the presentation will deal with the ethical objections to meat consumption. These are usually based on the alleged waste of vegetable protein, while people starve in Asia and Africa, and the aversion of some people to the destruction of life. However, the amount of meat consumed has little effect on the availability of grain in other continents and most major religions permit the killing of animals for food.

The Economic and Ethical Case against Meat Consumption.

JAMES B. MASON (Friends of Animals, Inc.).

Consumption of meat wastes precious protein and energy resources and perpetuates the barbaric exploitation of other animals. Nearly 500 million people in the world today are on the verge of starvation, yet 80 percent of U.S. grain is fed to livestock which requires up to 20 pounds of plant protein to produce one pound of animal protein. Production of one pound of meat generates 100 pounds of animal manure which pollutes our waterways and requires 20 times as much water and 8 times as much energy as production of an equivalent amount of plant protein. Consumption of meat violates our ethical obligation to ourselves, to our fellow humans, to other animals, and to the environment around us. We should discard the perception of nature as an opponent to be conquered, recognize the continuity and interdependence of all life, and conduct ourselves in such a manner as to cause least harm to other life. In achieving these vital social changes, we should provide for a smooth transition designed to minimize the dislocation to the national economy and any resultant human problems.

The U.S. Department of Agriculture Position.

CAROL T. FOREMAN (U.S. Department of Agriculture).

Actions of the U.S. Department of Agriculture affect deeply both the consumption and production of meat through human nutrition and livestock management research, regulation of the federal food assistance programs, inspection and grading of meat and meat products, maintenance of competitive marketing practices, and farm subsidies and loans. The past unqualified support for meat consumption is being increasingly qualified in light of recent nutritional and medical findings. The presentation will trace the history of USDA's involvement in meat consumption and production and will characterize current policies and attitudes and future plans.

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New Agricultural Crops

Arranged by GARY A. RITCHIE (Weyerhaeuser Co., Centralia, WA)

Thurs., 16 Feb. / Sheraton-Park / Assembly

9:00 a.m.-12:00 m.

Ancient Crops for the 21st Century.

RICHARD S. FELGER (Arizona-Sonora Desert Museum).

All over the world there are myriad plant and animal species which can be adapted to new agricultural systems. These species, which supported indigenous peoples, include many life-forms which can be developed for agroecosystems adapted to local conditions. Future agroecosystems can include high productivity of high quality protein with minimal energy and water consumption. It is estimated that about 1.5% of the world's seed plants, or approximately 3,000 species, are available for hybridization and selection as major new food crops. Examples of life-forms for potential agroecosystem diversity taken from the repertoir of major food resources of various Indian groups in North American deserts alone include: desert legume trees (mesquite, palo verde ironwood), desert palms (Hesper palm), columnar cacti (cardon), desert ephemerals (tepary, devil's claw, amaranth), saltgrasses (Palmer saltgrass), seagrasses (eelgrass), and even such endangered animal species as desert fish (pupfish) and sea turtles (green turtle). The potential for new crops has hardly been tapped.

Guayule, Domestic Natural Rubber Rediscovered

NOEL D. VIETMEYER (National Academy of Sciences)

Guayule, *Parthenium argentatum*, a tiny shrub native to southwestern Texas and the contiguous Chihuahuan Desert of Mexico, contains natural rubber. A recent National Academy of Sciences study shows that this rubber is virtually indistinguishable from that now imported from abroad. In 1910 guayule provided half the nation's rubber and the NAS study concludes it has the technical qualities to be used once more. Each year the U.S. absorbs about 1/5 of the world's natural rubber, so that domestically grown rubber is potentially of great national significance.

But the crop has other attractions too. In its native desert habitat guayule easily survives irregular rainfall and extended droughts. It may therefore, prove valuable as a new crop for arid, marginal regions of Mexico, Texas, New Mexico, Arizona and California. In particular it might provide an economic base for Indian Reservations, now among the most poverty stricken areas in the United States.

The Federal Government and the rubber industry have shown much interest in the NAS findings. The Mexican Government is already operating a large pilot extraction mill at Saltillo in Coahila state. In exhaustive road tests several dozen Mexican-made guayule tires have performed exceptionally well.

Skyrocketing energy costs adversely affect synthetic rubber prices and this, together with the increasing use of radial tires (which require twice the natural rubber of the older types), makes guayule's rediscovery very timely.

The potential of the winged bean - Psophocarpus tetragonolobus (L.) DC. - as an agricultural crop.

C. A. NEWELL and T. HYMOWITZ (University of Illinois at Champaign-Urbana, Urbana, Illinois 61801).

The genus *Psophocarpus* is composed of about 9 species, 8 of which are indigenous to Africa. The ninth species is *P. tetragonolobus* or the winged bean. The plant is a climbing perennial with large 4-angled pods grown on a trellis as an annual. It is cultivated in the high rainfall tropics and subtropics of Southeast Asia, Oceania and Africa. The seeds have about the same quantity and quality of protein and oil as that of the soybean. In addition, the tubers have about 16 to 20% protein. In some countries leaves, flowers and young pods form a minor part of the human diet. There appears to be a large amount of morphological and chemical variation within the domesticate. However, seed collections are few in number and a major effort should be made especially in Papua New Guinea and Indonesia to obtain additional germplasm. The greatest potential for the winged bean is as a protein crop for those high rainfall areas which traditionally depend on staple crops that are low in protein such as yams and cassavas. Unfortunately, relatively few agronomic, nutritional and plant breeding studies have been conducted on the crop.

Jojoba - A New Crop for Arid Regions.

LeMOYNE HOGAN (University of Arizona - Tucson)

Jojoba [*Simmondsia chinensis* (link) Schneider] an evergreen dioecious shrub native to the Arizona uplands of the Sonoran Desert, Coastal Southern California, Baja and part of Sonora, Mexico has considerable value as a new agricultural crop for arid regions of the world. It produces a seed (or bean) that contains between 40 and 50 percent by weight of a colorless, odorless, oily liquid referred to as "jojoba oil". Jojoba oil is an unsaturated, liquid wax almost identical in composition to sperm whale oil. This wax may be used in industries in a wide variety of applications including lubricants, paper coatings, polishes and pharmaceuticals. Studies in the United States, Israel and Mexico indicate that jojoba can be successfully cultivated in areas where suitable climatic and soil conditions are found. Yields of 3 to 5 pounds of dry seed per plant at 8 years can be expected. A jojoba plantation should produce 1500 pounds of jojoba oil per acre at 12 years of age. At present jojoba oil is only available in limited quantities from seed collected from wild stands. Intensive research programs for adapting jojoba to cultivation are under way at the University of Arizona, University of California - Riverside, Ben Gurion University, Beer-Sheva, Israel and by several state and federal organizations in Mexico. There is worldwide interest in jojoba, especially in the arid regions of the world. It can become a very important new agricultural crop for developing countries.

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Public Support for Agricultural Research and Extension Education: Evaluation of Benefits from Public Investments

Arranged by B. R. EDDLEMAN (Mississippi State Univ.)

Thurs., 16 Feb. / Sheraton-Park / Madison

3:00 p.m.-6:00 p.m.

Issues and Priorities in Public Funding of Agricultural Research and Extension Education.

JAMES NIELSON (Conservation, Research and Education, U.S. Department of Agriculture).

The rationale for public investments in agriculture research and extension and the nature of their pay-off to society will be outlined briefly. Recent and prospective changes both inside and outside the agricultural sector will be discussed, especially as they relate to uncertainty and productivity growth in agriculture. Changing goals of society and the need to deal with the resulting trade-offs (such as productive efficiency versus quality of environment) will be considered. The paper concluded with comments on the impact of these factors on the research and extension agenda and the management of public investments in agricultural research and extension.

Federal Funding Obstacles for Food Research. J. S. CORDARO (Office of Technology Assessment).

Competition for Federal funds to support a wide variety of worthy activities has intensified in the past few years. Both the executive and legislative branches of our Government have strengthened their capability to analyze issues and to rationalize budget levels, program priorities, and cost-benefit measures. All of this is supposedly done in the name of getting more value for tax dollars while trying to achieve some specific national and/or local goal. Stepped-up involvement in the planning and monitoring of programs by the Office of Management and Budget; increased coordination among the various agencies; Congress' new budget office and other complementary facilities in the General Accounting Office, Congressional Research Service; and Office of Technology Assessment seem to provide ample institutional capability to improve the allocation of scarce resources. To these institutional structures add the newly arrived zero-based budgeting and the Administration's plan for reorganization. With these institutions and their establishing, developing, and expected-to-change process and procedure, is food research receiving adequate funding? If not, where are the problem areas: Has the food research community been aggressive enough in pushing for funds? Have they exercised rigorous management controls to ensure an effective and efficient program? On the other hand, have the controllers of the purse strings understood the nature of the food problem and the contributions research can make? What changes can be made to assure that science and technology receive adequate levels of funding?

Returns to Investment in Agricultural Research. WILLIS L. PETERSON (University of Minnesota).

Agricultural research is an investment having both a cost and a return to society. Current public expenditures on agricultural research and extension exceed one billion dollars per year. The returns to this investment consists of the additional output of goods and services made possible by the new knowledge produced. The additional output can be food and fiber or greater production of nonagricultural products made possible by the release of conventional resources from agriculture, mainly labor. Recent estimates of the rate of return to investment in agricultural research are in the range of 36 to 46 percent. The main beneficiaries are consumers especially those with low incomes. In the aggregate the main factor affecting the returns to agricultural research appears to be the dollars of related output per dollar of research. Although this figure declined during the 1950s and 1960s it has increased during the early 1970s due to higher prices of farm products and a greater volume of output. Because of the stochastic nature of the payoff to research it is virtually impossible to predict the profitability of individual projects. As in the case of drilling for oil, the gushers must more than pay for the dry holes.

Projections of Future Agricultural Productivity Under Alternative Rates of Increase in Research and Extension Investment. YAO-CHI LU, (Economic Research Service, U.S. Department of Agriculture).

This study provides information to help answer the question whether limits to agricultural productivity growth have been reached. Results indicate that with adequate research and extension (R&E) effort, agricultural productivity would not reach the limits to growth by year 2000. This result was obtained by analyzing historical productivity growth paths, simulating future growth paths, and evaluating emerging unprecedented technologies. Historically, agricultural productivity grew along successive S-shaped growth curves. As productivity reached or approached the limits to growth under the dominant technology, a new technology emerged. Emergence of the new technology caused productivity to break through the limits imposed by the old technology and shift productivity growth to a new S-curve. Currently, we are in the middle of an S-curve in the "early science" epoch. If we project along this curve, productivity would not reach its limits by year 2000. In simulating future productivity growth paths, public R&E expenditures for agriculture, educational attainment of farmers, and weather are emphasized as causal variables. Under alternative R&E growth rates, productivity indexes are projected through year 2000. Emergence of three unprecedented technologies identified in the study could shift future productivity to another new S-curve. Their impacts on productivity growth are incorporated in the projections.

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Pesticides: Role in Agriculture and the Environment

Arranged by T. J. SHEETS (North Carolina State University, Raleigh) and DAVID PIMENTEL (Cornell Univ.)

Fri., 17 Feb. / Sheraton-Park / Wilmington

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Role of Pesticides in Increasing Agricultural Production. FRED H. TSCHIRLEY (Michigan State University).

The trend of world population is upward, and would be so even if all nations of the world immediately achieved a fertility rate equal to replacement level. Because population growth is inevitable, increased food and fiber production is also inevitable. Historically, food production has equalled or exceeded population growth. A world population of 4 billion and a doubling time of about 37 years begs the serious question of whether agricultural productivity can keep pace. Increased agricultural productivity must be accomplished primarily on lands that are already in cultivation. Additional land could be cultivated productively, but only with high inputs of water and fertilizer. Both require an energy expenditure that will be expensive if available at all. Crop productivity losses to pests of all kinds are estimated to be about 30 percent. If no pesticides were used, loss estimates range upward to 50 percent or more. Alternatives to chemical pesticides are not available for all crops in all places. Moreover, we should not expect rapid development and acceptance of alternative control methods that are effective in diverse edaphic and climatic regimes. For these and other reasons to be discussed an upward trend in pesticide useage is expected in the next 10 years, but the rate of increase will be lower than in the past. Holistic approaches to crop protection from pests are expected to result in more judicious use of pesticides, thus ameliorating the environmental impact. Lastly, the phaseout of persistent pesticides, already in progress, is expected to continue.

The Role of Pesticides in Stabilizing Agricultural Production, GERALD A. CARLSON, (North Carolina State University).

There is a demand by the public for a year-around supply of high-quality agricultural products. However, storage, foreign trade, and product substitution shields the consumer from short-run production variabilities due to pests and weather. Chemical pest controls are widely known for their ease of implementation in the event of high pest populations or unseasonal crop susceptibility. Many cases can be cited of averting wide fluctuations in individual farmer yields by the use of pesticides. The use of pesticides for insurance purpose is evidence that farmers believe in the use of pesticides to stabilize incomes. However, the pertinent question is whether this short-run stability is coming at the expense of longer-run instability relative to other means of crop production of equal social cost. What is the history of yield fluctuations as pesticide use has increased relative to other pest management resources? How do yield variabilities of high pesticide control programs compare with the variabilities associated with other control technologies? Individual grower decisions on pesticide use for yield stabilization may differ from socially desired levels. This occurs if there are off-farm costs associated with pesticides that are not proportional to the stabilizing effects. Pesticide use regulations should be evaluated for their impact on producer income variability.

Socioeconomic Impacts of Changes in Pesticide Usage. EDDY L. LADUE (Cornell University).

Adoption of available and developing technology may allow farmers to achieve a net economic benefit from reduced pesticide use. However, the costs and benefits will be inequitably distributed among regions and individuals. Loss of the insurance attributes of pesticides will provide economic and social problems for farmers and rural communities.

Pesticides and Energy Utilization. JOHN H. BERRY (National Economic Analysis Division, Economic Research Service, USDA).

Pesticides has become one of the most important inputs used in farm production. In 1971, more than 828 million pounds were used by farmers--up from 503 million pounds in 1966. Production of these pesticide products is heavily dependent upon adequate supplies of petroleum products. About 95 trillion Btu's were used in pesticide production in 1974. This is equivalent to about half the energy used in farm harvesting operations and about equivalent to that used in grain handling and drying operations on farms. Energy used in pesticide production has enabled farmers to increase the amount of food available while using less land for food production, to reduce waste and maintain or create a quality of food preferred by consumers, and to reduce the risk of crop failure and food losses from production through home consumption. Yet because there are environmental concerns about pesticide use and a need to conserve energy, cost benefit analysis and energy accounting are needed in evaluating various pest control strategies and energy priorities that relate to pesticide production and farming practices.

Non-target Effects of Pesticides in the Environment. JOHN L. BUCKLEY (Consultant, Environmental Protection Agency).

It is virtually impossible to conceive of a pesticide that will not cause non-target effects in the environment. Non-target effects are a result of at least the following factors: Pesticides are biologically active--few, if any, are active against only the target pest; most pesticides are applied to pests in the outdoor environment and thus come in contact with non-target organisms; the more persistent a pesticide is, the greater the chance of contact with non-target organisms; the more persistent a pesticide is, the greater the chance of its being moved about in the environment, and the greater the array of environments and organisms it will contact; and characteristics that contribute to mobility of a pesticide include solubility and volatility, capacity to be adsorbed to small particles, and capacity to be taken up and concentrated in living organisms. Pesticides in use today are generally less persistent than many pesticides used a decade or so ago. Consequently, non-target effects are less widespread than they were then. "Next Generation" pesticides, such as viruses, pheremones and hormones may cause non-target effects which have not yet been adequately studied. Integrated pest management offers the most promising means of minimizing non-target effects.

Pesticides and Human Health. WILLIAM F. DURHAM (Health Effects Research Laboratory, Environmental Protection Agency).

Pesticides provide benefits to human health through control of certain vector-borne diseases and through increased production of food and fiber. However, pesticides also present a potential toxic hazard to human health. The acute hazard from accidental exposure to large doses is rather well-defined. Studies of accidental deaths from pesticides in the U.S. indicate an annual incidence of less than 1 per million population. The hazard of long-term, low-level exposure to pesticides is more difficult to assess. Studies in experimental animals have pointed out some specific problems which involve the real possibility of hazard to man. Some of these hazards to be discussed include contaminants in pesticide formulations, nitroso derivatives of pesticides, and neurotoxic effects of organic phosphorous compounds.

Agriculture Without Pesticides. DAVID PIMENTEL (Cornell University).

Current U.S. crop losses from pests are 33%. Taking into account that 17% of U.S. crop acreage is treated with herbicides, 6% with insecticides and 1% with fungicides, crop losses, without pesticide use and employing some alternate controls were estimated to increase from 33% to 41%. Total crop losses, based on dollar values, thus would increase by 8%. Human food losses based on calories without pesticides was estimated at only 4%. Based on this estimate, no serious food shortage would occur in the United States if pesticides were withdrawn, because most staple foods would not be greatly affected by the withdrawal of the chemicals. Nonchemical control methods currently are used more extensively in the United States to protect crops from pests than are pesticides. Nonchemical controls for insect control are employed on about 9% of the crop acres, compared with only 6% treated with insecticides. For control of plant disease, nonchemical control is used on 90% of the acreage, compared with less than 1% treated with fungicides. Mechanical weed control is used on an estimated 80% of the crop acreage, while about 17% is treated with herbicides. The environmental impact of pesticide use is estimated to cost the nation at least $3 billion annually. Taking these external costs into account in a benefit/cost analysis of pesticide use in agriculture, the dollar return is $3 per $1 invested in pesticides.

Role of Pesticides in Pest Management Systems. L. D. NEWSOM (Louisiana State University).

Use of conventional pesticides is a key tactic in the strategy of pest management. It will continue to play this role for the foreseeable future. No effective alternatives to the use of pesticides as a basic component of pest management systems has been discovered for controlling pests of the annual crops on which mankind depends for food and fiber. Pesticides are as important in pest management systems as are chemotherapeutic agents in human and veterinary medicine. They can be used effectively, safely, and with minimal environmental hazard by observing the basic principles of physiological and ecological selectivity.

9. MEDICINE AND HEALTH

Prevention of Genetic Disease and Developmental Disabilities

Arranged by TAMAH L. SADICK and SIEGFRIED M. PUESCHEL (Rhode Island Hospital, Providence)

Mon., 13 Feb. / Shoreham / Forum

9:00 a.m.-12:00 m. and

3:00 p.m.-6:00 p.m.

Screening of Newborn Infants. ROBERT GUTHRIE (State University of New York at Buffalo).

More than 30 different inherited metabolic conditions have been detected by routine screening of newborn infants with various tests now available. Yet in most programs, only one test - that for phenylketonuria (PKU) - is employed. By organization of large screening regions to obtain 50,000 to 150,000 filter paper blood specimens annually, and use of automated laboratory equipment to handle this large volume of specimens, it is practical to screen for phenylketonuria, hypothyroidism, galactosemia, homocystinuria, maple syrup urine disease, histidinemia, tyrosinemia and hemoglobinopathies in a cost-effective manner. In addition to the usual nursery blood specimens, some programs receive prenatal blood, cord blood, blood collected at 4 weeks of age, and urine-impregnated filter paper. Recent progress in the expansion of multiple newborn screening will be discussed with particular attention to the establishment of multi-state regional screening programs in the United States, as well as features of a number of regional newborn screening programs in other countries. Based upon this experience, recommendations can be made for organization of new programs.

Genetic Screening: The Heterozygote Experience.

CHARLES R. SCRIVER. McGill University-Montreal Children's Hospital Research Institute, Montreal.

Screening of heterozygotes can serve three objectives: i) the identification of those at risk for passing on a potentially harmful gene to offspring; ii) the detection of those at risk for their own health because they possess a genetic variant; iii) the enumeration of gene frequencies in populations. Practical experience is large only in the first instance (e.g. screening for Tay-Sachs, β-thalassemia and sickle carriers). Increasing interest in the second objective is anticipated as the equilibrium between specific functions of gene products and environmental events (health) is understood and disequilibrium (disease) is interpreted (e.g. in LDL-receptor deficient/negative hypercholesterolemia). Experience with the third mode of screening has delineated a high prevalence of genetic polymorphism and about 20 percent heterozygosity per structural gene locus in man. Current practice reveals problem areas in heterozygote screening. One concerns specificity and sensitivity of the process. Methods to reduce costs of false-positive and false-negative test results deserve extensive research and analysis before programs are established. Another concerns attitudes of clients which influence participation and the response to test results. If heterozygote screening is to achieve its objectives, there must also be education of clients and advocates regarding the biological and sociological significance of heterozygosity.

Screening for Alpha-1-antitrypsin Deficiency.

RICHARD C. TALAMO, M.D. (The Johns Hopkins University School of Medicine)

Carrier Detection in Duchenne Muscular Dystrophy and the Implications for Genetic Counseling.

MARIE-LOUISE LUBS (Children's Hospital, Denver, Colorado).

Duchenne Muscular Dystrophy is a severe progressive disorder with X-linked recessive inheritance. Affected males never live to reproduce and the gene is maintained in the population by means of a proportionately high mutation rate. The new mutation occurs approximately twice as often in the female as in the male. About one half of all cases are born in families with a negative family history. In these families it becomes most important from a genetic counseling standpoint to identify the affected males who are themselves a new mutation, since their mothers would not be carriers and would have virtually no recurrence risk for future pregnancies. Attempts to develop a reliable carrier test have, so far, been futile. Although muscle pathology observed in a biopsy, creatine phosphokinase level in the blood serum, and rate of protein synthesis by polyribosomes in muscle tissue would all detect the majority of carriers, there is still a significant overlap with normal controls in all three methods. However, it is possible to assess relative risks of the carrier state based on the results of one or more of the carrier tests, family history and clinical variables such as carrier symptoms and age. Since the methods involving muscle biopsy are both cumbersome and expensive, serum CPK is the single method used by most muscle clinics. The CPK distribution in a large sample of carriers will be presented as well as methods of assessing the risk of an individual being a carrier.

Prenatal Diagnosis of Chromosomal Disorders

CECIL B. JACOBSON, M.D., (Geo. Wash. Univ. School of Medicine and Reproductive Genetics Center).

The demonstrated reliability of prenatal chromosomal analysis during the past decade has allowed counselling of pregnancies in three high risk groups, e.g. birth of previous trisomics, translocation carriers, and X-linked carriers. Additional clinical populations of lower risk, however, are now composing the majority of prenatal studies, i.e., advanced parental age, poor reproductive history and siblings with chromosomal defects.
Recently requests for screening are coming from couples of probable neutral risk based upon their educational, occupational or anxietal experiences. Our laboratory has now processed over 2,000 cases with experiences that parallel other major units, i.e. (1) The demand for services exceeds laboratory capacity, (2) The laboratory must divide every two years, (3) As medical awareness increases, the utilization of prenatal screening appears exponential in growth, (4) The number of patients planning subsequent pregnancies based upon the availability of prenatal diagnosis is increasing.

Prenatal Detection of Neural Tube Defects (NTDs) Using the Alpha-Fetoprotein (AFP) Assay.

Aubrey Milunsky (Harvard Medical School and Eunice Kennedy Shriver Center).

Open NTDs in the fetus are associated with raised amniotic fluid alpha-fetoprotein levels. Our experience with the AFP assay in over 10,000 cases will be presented together with the lessons learned. The recurrence risk for NTDs after 1 affected child may be less than 2% in the U.S. We have not missed any open NTDs prenatally, have detected about 90 defects, and have a false positive rate of about 0.1%. A host of different fetal anomalies have also been observed with elevated amniotic fluid AFP levels. Despite the non-specific nature of the amniotic fluid AFP assay, it remains a valuable tool. An analysis of worldwide experience with maternal serum AFP screening will be coupled with evaluation of the problems we and others have encountered. Thus far all our open NTDs have been associated with elevated maternal serum AFP. Moreover twins and certain obstetric complications which have an increased perinatal morbidity and mortality may also be detected prior to 20 weeks gestation with the AFP assay. Maternal serum AFP screening requires much more study before any nationwide effort can rationally be contemplated.

Prenatal Diagnosis of Duchenne Muscular Dystrophy.

MAURICE J. MAHONEY (Yale University), FLORENCE P. HASELTINE (Yale University), JOHN C. HOBBINS (Yale University), BETTY Q. BANKER (Case Western Reserve University).

Placental vessel puncture has made it possible to study blood constituents of the human fetus and thereby to arrive at diagnoses which heretofore have not been possible using amniotic fluid or cells. The first diagnoses attempted from fetal blood used red cells for detection of hemoglobinopathies. Attempts are now being made to use fetal plasma. Early results suggest that Duchenne muscular dystrophy (DMD) can be diagnosed by measuring the activity of the enzyme creatine phosphokinase (CPK). DMD is a fatal, X-linked recessive disease, the most common of the childhood muscular dystrophies. Plasma CPK activity is increased in DMD starting in the newborn period. This elevation plus well established muscle pathology are also present in early fetal life. The first attempts to diagnose DMD prenatally have demonstrated: 1) a normal fetal plasma CPK activity correlated with the later birth of a normal boy; and 2) a several fold elevated CPK activity in a male fetus whose muscles showed extensive histologic changes characteristic of progressive muscular dystrophy. Other measurements using fetal plasma, which will expand both diagnoses and treatment of the fetus in utero, will undoubtedly follow. These advances will depend to a considerable extent on ultramicro technics in the laboratory and improved placental sampling that minimizes or eliminates the contamination of fetal blood by maternal blood or amniotic fluid.

Prenatal Diagnosis of the Hemoglobinopathies.

DAVID G. NATHAN (Children's Hospital Medical Center and Harvard Medical School), BLANCHE P. ALTER (Children's Hospital Medical Center and Harvard Medical School).

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Social Acceptance of Preventive Dentistry Programs

Arranged by DONALD B. GIDDON and RICHARD D. MUMMA, JR.
(New York University)

Tues., 14 Feb. / Shoreham / Executive

9:00 a.m.-12:00 m.

Comparative Status of Preventive Dental Programs in the United States and Abroad. MYRON ALLUKIAN, JR. (Bureau of Community Dental Programs, Department of Health and Hospitals, Boston, Mass.)

Although there are a number of dental diseases and a variety of preventive measures for these diseases, fluoridation is the only preventive measure that may ultimately have an impact on the dental health of an entire community in a cost-effective manner. By the end of 1975, 105 million people in the United States were living in fluoridated communities. Although 32 years have passed since fluoridation was first implemented in the United States, many communities throughout the world are not taking advantage of the health & economic benefits of this sound preventive measure. Apathy, disinterest, misinformation politics and lack of skills in community organization and education are some of the factors which are responsible for the lack of implementation. The effectiveness practicality, and politics of fluoridation will be discussed relative to other preventive measures in the United States and abroad.

Economic Analysis of Dental Health Education and Other Preventive Programs. PAUL J. FELDSTEIN (University of Michigan, Ann Arbor).

A newly developed large scale econometric model of the dental sector is used to estimate the economic effects of preventative dental care. The first part of the paper discusses the computerized model of the dental sector; how it was constructed, its separate parts, and its applications for policy and forecasting. The model is then used to simulate different public policies to increase preventative care, e.g., an increase in the percent of the population with fluoridated water supplies or providing subsidies for certain types of dental visits. The costs and effects of such different policies are then compared, along with the consequences of such policies on the dental sector.

Social Factors Involved in Acceptance of Preventive Health Programs ALBERT F. WESSEN (Brown University Medical School).

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Pharmacology on the Firing Line

Arranged by LOWELL M. GREENBAUM (Columbia University)

Tues., 14 Feb. / Shoreham / Executive

3:00 p.m.-6:00 p.m.

Pharmacology; Its Current Role. LOWELL M. GREENBAUM, PH.D. (College of Physicians & Surgeons Columbia University).

Few biomedical scientists are faced with such direct challenges from society as is the pharmacologist. The study of drug action and drug abuse, necessary human investigation and protection from abuses of such investigation, the need for newer and safer drugs, the demand by society for answers to the cure for diseases such as cancer and addiction - all put the pharmacologist on the firing line. Despite this sensitive postion, relatively few understand what a pharmacologist accomplishes and what kind of work they have been doing. The symposium will bring together four expert pharmacologists in fields of great societal interest: cancer therapies, the legal problem of food additives, human investigation and addiction. It is presumed that such exposure will result in stimulating and exciting reactions for the public as well as pharmacology.

Regulation of Human Research: Will There Be A Gap Between Policy and Implementation? SORELL L. SCHWARTZ (Georgetown University).

Cancer Therapies: Who's Right? JOSEPH R. BERTINO (Yale University).

The Delaney Amendment: Is It Realistic? JOHN DOULL, M.D., PH.D. (Univ. of Kansas Medical Center, Kansas City, Kansas 66103).

The basic premise of the Delaney Amendment is that the safety of foods can be determined on a yes-no basis. Inherent in this approach is the same problem that one encounters in trying to establish whether a substance is or is not a poison. The problem is that absolute safety does not exist for any chemical whether it is in foods or elsewhere. As Paracelsus stated over 400 years ago, "All substances are poisons, it is only the dose which separates a poison from a remedy." The Delaney Amendment approach excludes not only the concept of dose in evaluating safety but also the concept of balancing potential benefits against possible risks from the use of such substances. Although each of us would like our chemical environment to provide us with maximum benefits without any risk, we recognize that all of our human endeavors entail some risk and we are willing to accept some of these risks in order to enjoy the associated benefits. Thus the risk estimation approach, in addition to being scientifically more acceptable than the Delaney approach, is also more realistic in terms of providing practical solutions to the problems of food safety.

Can Pharmacology Be Of Help In Addictive Disorders? JEROME H. JAFFE (New York State Psychiatric Institute).

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Assessing the Contributions of the Social Sciences to Health

Arranged by M. HARVEY BRENNER (Johns Hopkins University)

Wed., 15 Feb. / Shoreham / Executive

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Demographic Methods and Their Applicablity in the Social and Health Sciences. NATHAN KEYFITZ (Harvard University)

Mortality has been studied for whole countries and other (necessarily heterogenous) groups defined by area. Following a long tradition we have an abundance of methods and data on national mortality by age, sex, and cause, some of it highly accurate. We have given much attention to refinement of techniques for making life tables and other ways of analyzing such data. Such materials and methods have been invaluable over the long period in which infectious diseases have been the main target of medical science. More information is now required for homogeneous subgroups in which the population is classified by income, education, occupation, diet, health condition, smoking and other relevant kinds of behavior. For the analysis of such data, we need to use sickness-and-death models and in other ways generalize the life table. Samples for obtaining information on mortality will have to be much larger than those used in fertility surveys--there is no population for which death is as common an event as is childbearing for women 20-29 years of age. But records are now kept on many of the required facts in hospital, physician, insurance company, employer, and other files. The problem is to assemble, computerize, tabulate and analyze them.

Health and Fertility. JOHN F. KANTNER (The Johns Hopkins University).

There are important connections between levels of health and nutrition and 1) the capacity to conceive and bear children, 2) variations in the lifetime risk of pregnancy, and 3) the motivational basis for decisions regarding the timing and quantity of fertility. In the first part of the paper, the state of knowledge on these relationships is examined. Conversely, fertility can affect health both at the individual and societal levels. The most significant question probably is the relationship of fertility to development, since it is through development that major gains in health are made. There are also important issues having to do with the effects of such aspects of fertility as age of the mother and the number and spacing of children on the health of the mother, her offspring, and her family. The paper ends with a review of the evidence and an attempt to reconcile conflicting findings.

Industrialization and Economic Growth: Estimates of their Effects on the Health of Populations. M. HARVEY BRENNER (The Johns Hopkins University).

The health of populations is influenced by a great number of factors that occur within the ecology of man's physical and social environment. These factors can be systematically grouped under (1) the natural physical environment, including climate and geography; (2) the man-designed physical environment, including the quality of air, water, and the character of agriculture, and intrusions into the climatic and geophysical setting; (3) social-psychological trauma, or "life stresses" contingent on human interaction as they interact with child-rearing patterns; (4) the extent and types of "social-support" networks; (5) "lifestyle," including exercise, diet, and use of tobacco, etc.; and (6) public health and medical science and technology. Each of the six groups of factors are profoundly influenced by the processes of industrialization and economic growth. With the comparative decline in importance of the infectious diseases as causes of death, social-psychological trauma, social support and "lifestyle" come to be the more important factors. An equation is presented for the first time by which mortality trends in populations can be statistically explained. This equation includes secular and short-term trends in real per capita income and its distribution, unemployment rates, education levels, and public welfare expenditures.

The Effects of Different Political and Economic Organizations on Health Care Delivery. PETER KONG-MING NEW (University of Toronto), JUDE THOMAS MAY (University of Oklahoma)

This paper will review the various impact political and economic organizations have had on health care delivery. Issues related to health policies and the implementation of new health delivery programs will be examined in some detail. The planning and establishment of former O.E.O. neighborhood health centers will be described to illustrate the significant problems and issues in health delivery.

The Bearing of Sciences Knowledge on Medical Education and Practice. STANLEY REISER (Harvard University Medical School).

This paper examines some of the historical circumstances which have created resistance to the integration of material from the social sciences into the curricula of American medical schools in the 20th century. It further explores present problems and future prospects of the social sciences in medical education and their use by physicians in practice.

Cultural and Environmental Factors in the Definition and Understanding of Health. NANCIE L. GONZALEZ (University of Maryland).

Anthropologists study both the physical and the cultural components of the human condition. Crosscultural studies demonstrate quite convincingly that the definition of illness itself, as well as the behavior patterns surrounding it, is largely culturally determined. Some diseases may be more prevalent in certain populations because of environmental pressures, sometimes interacting with physical conditions which are genetically controlled. However, the ways in which the people perceive their condition and the ways in which they learn to cope with it must also be taken into account in understanding the delicate balance between health and dis-ease. This paper will present an overview of what anthropologists generally term "ethnomedicine", focusing upon the symbolism and the social organization of what we may call the domain of health.

The Influence of Psychosocial Factors on Susceptibility to Physical Illness. WILLIAM SCHOFIELD (University of Minnesota)

Groups of individuals who are homogeneous with respect to demographic variables and living in the same general and stable environment as regards diet and exposure to infections and toxins reveal marked individual differences in their frequency of illness. Similarly, groups of individuals exposed to acute stress (e.g., fire, flood, war) show marked individual differences in post-trauma incidence of physical illness. It is hypothesized that there is a factor of "susceptibility," or its converse "resistance," and that psychological variables are important determiners of the level of susceptibility or resistance. Two major lines of research seek to clarify these variables. One line looks at the relationship between significant changes in the individual's life situation and his subsequent disease history; the other has attempted to establish definitive personality types associated with specific illnesses. The first line of research grows out of the hypothesis that prolonged or cumulative stress lowers resistance, while the latter sees certain personality traits as conducive to the creation and maintenance of stress. Behavioral scientists have contributed to research design and in particular to techniques of measurement of both stress and personality which permit more exact study of the relation of these variables to physical illness.

Socio-cultural and Psychological Aspects of the Utilization of Health Services. JAMES R. GREENLEY (University of Wisconsin-Madison).

The purpose of this paper is to review theory and research on selected socio-cultural and psychological aspects of health services utilization. Factors related to usage of general medical and mental health care are examined in several areas: psychological orientations and attitudes, socio-demographic and situational factors, and the structure and organization of health care services. The magnitude and social policy implications of relative "under" or "over" utilization of health services by various groups are addressed. Conceptual and methodological problems and possibilities are identified and critical future research areas and questions are explored. Particular attention is paid to the childhood socialization of health care attitudes and orientation, psychological distress and social need, cost and payment mechanisms, societal attitudes toward medical care and alternative health care providers, and the increasing bureaucratization and specialization of health services.

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Solving the Riddle of Cancer: Role of the Physician

Arranged by ALBERT B. LOWENFELS (New York Medical College, New York City and Westchester County Medical Center, Valhalla, NY)

Thurs., 16 Feb. / Shoreham / Tudor

9:00 a.m.-12:00 m.

Introduction. ALBERT B. LOWENFELS (New York Medical College)

In addition to his traditional diagnostic and therapeutic roles, the practicing physician has an unusual opportunity to gather data that will help solve the riddle of cancer. Many previous discoveries relating to the etiology of cancer have been made by astute physicians after observing their own patients, and some human tumors caused by drugs or environmental carcinogens have been detected prior to the availability of any animal model. It seems highly probable that additional advances will be made by the alert physician at the bedside and in the laboratory. It is the aim of this symposium to suggest ways to increase the physician's effectiveness as a scientist investigating the problem of cancer.

The Alert Physician: Selection and Education.

THOMAS S. COTTRELL (New York Medical College)

The physician scientist working as data-gatherer by the bedside can only function as well as his training prepares him. Selection of qualified medical school candidates is the first step in the process of educating the alert physician. Care must be exercised to select competent, motivated students based on quantitative and qualitative review of their academic records. To a large extent, the student's educational experience in medical college will determine how he practices medicine. Discussion will emphasize role-model teaching and will describe in detail a number of traditional and non-traditional medical educational modes that will prepare the alert physician. Suggestions will be offered for changing the teaching environment in order to inculcate desired values.

The Physician as Skilled Observer.

JOSEPH F. FRAUMENI, JR. (National Cancer Institute)

Since the days of Percivall Pott, the initial leads to environmental causes of cancer have been supplied mainly by alert physicians. The discoveries include lung cancer from chromium and halo ethers, lung and nasal cancer from nickel, mesothelioma from asbestos, nasal cancer from wood dust and isopropyl oil, liver angiosarcoma from vinyl chloride, bone sarcoma from radium, leukemia from benzene and alkylating agents, and vaginal cancer from transplacental spread of synthetic estrogens. Clinical detection of a hazard is enhanced when the case clusters involve neoplasms that are ordinarily rare in the population. A means for identifying clusters of more common tumors is provided by the recent mapping of U.S. cancer mortality on a county level, revealing high-risk communities where environmental factors may be important. In the past, physicians have also provided major clues to host determinants of carcinogenesis by recognizing patients with genetic and developmental traits predisposing to cancer. These include tumors associated with immune deficiency syndromes, cytogenetic abnormalities, and DNA repair defects. Although based on rare events, such clinical observations are not only a key stimulus to experimental and epidemiologic research, but by themselves contribute new insights into fundamental mechanisms of cancer etiology.

The Physician as Basic Scientist.

JUDAH FOLKMAN (Harvard Medical School)

Conventional wisdom has it that physicians work mainly by intuition; they must never appear to be in doubt; therefore they are dilettantes at laboratory experimentation. Serious research should be left to the full-time scientist.

However, nature is not organized in the same way that universities are. She occasionally takes pity on the embattled physician and reveals to him clues and hints that she might never disclose to a molecular or cell biologist. In the long accumulated experience of caring for cancer patients, there is a resevoir of untapped fundamental information. Unfortunately, it is not in useful form for the basic scientist because it is mostly anecdotal and not quantitative. Neither is it of any use to the physician who, having observed for example, the strange repetitious pattern that thyroid cancer cells spreading to the lung, form metastases of equal size, says "Yes, we see this," and passes to the next bed. Only the physician with some scientific training, or the one who is actively pursuing a research program stops to wonder. By working back and forth between the laboratory and the bedside, or sometimes by leaving the bedside for the laboratory, he can occasionally make a contribution as fundamental to basic biology as it is to clinical practice. I will discuss some recent examples.

A Multidisciplinary Approach to Cancer Research.

JOHN H. WEISBURGER (Naylor Dana Institute for Disease Prevention, American Health Foundation)

The word "cancer" denotes a group of diseases in which cells have lost their regulation by the host. As different cancers have separate, multifactorial causes, and since a single discipline often fails to provide the necessary breadth and investigative power, it is understandable why a multidisciplinary approach has yielded the best results. Such research can be initiated by observations made by the physician, and then progress to the development of sound animal models and in-vitro studies before returning to metabolic studies in humans. The totality of these efforts from man to molecule and then back to man encompasses a variety of disciplines requiring a broad perspective in order to reach reasonable and soundly based conclusions. Multidisciplinary approaches have already clarified the complex relation between environment, host, and cancer. It is hoped that further efforts along the same lines will allow us to accumulate additional knowledge so that the majority of human cancers can be eliminated by prevention--the ultimate goal of all cancer research.

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Statistics and Environmental Factors in Health

Arranged by ALICE S. WHITTEMORE (Hunter College, City Univ. of New York)

Thurs., 16 Feb. / Shoreham / Executive

3:00 p.m.-6:00 p.m.

Methods of Analyzing the Mortality of Workers Exposed to Low Levels of Ionizing Radiation.

E. S. GILBERT (Battelle Pacific Northwest Laboratories).

Assessing the health effects of chronic low-level exposures to environmental contaminants poses a number of challenging problems. These problems are illustrated by a current study of the effects on mortality of occupational exposure to ionizing radiation at Hanford. Because radiation exposure is accumulated over time, it is correlated with survival - that is, the longer one survives the more opportunity one has to accumulate exposure. Radiation is also correlated with age, calendar time, length of employment and occupation, all variables which potentially affect mortality. The relationship of death rates and radiation exposure is examined by a method that corrects for the above correlations. In addition, death rates for Hanford workers are compared with those of the U.S. population.

Statistical Lessons from CHESS.

RONALD E. WYZGA (Electric Power Research Institute).

Between 1967 and 1975, the Environmental Protection Agency (EPA) carried out a comprehensive program to investigate any relationship between air pollution and morbidity. Most of the epidemiological studies carried out under this program were known as the Community Health and Environmental Surveillance System (CHESS) studies. Controversy has arisen from the conclusions, interpretation and application of the CHESS results, and a Congressional subcommittee undertook an evaluation of the scientific and technical adequacy of these studies. Subsequent reanalyses of the original CHESS data have been undertaken and have raised questions about the data quality and the original findings. This paper examines the original CHESS published reports and the reanalyses of the CHESS data in an effort to make constructive comments for future epidemiological studies. Sampling methods, stratification, and size of sample and their influence on the power of hypothesis tests in CHESS - type studies will be considered. The conclusions will suggest designs for future epidemiological experiments which may be able to avoid some of the problems encountered in the CHESS studies.

Statistical Aspects of Carcinogenic Risk Assessment.

DAVID G. HOEL (National Institute of Environmental Health Sciences, NIH).

Environmental decision making currently employs methods of carcinogenic risk assessment to extrapolate results from high dose rodent studies to low dose human effects. Much attention has been given to the mathematical description of the dose response function in carcinogenesis with the objective of estimating the low dose response. The models used for this purpose are based upon a multi-stage mutational theory of somatic cell alterations. This talk will discuss these models with particular attention given to their statistical properties.

Statistical Analysis of National Cancer Institute Carcinogen Bioassay Data. KENNETH C. CHU (National Cancer Institute, NIH).

The statistical methods used in the analysis of tumor incidence and survival data generated from National Cancer Institute carcinogen bioassays will be discussed qualitatively. Some of these methods include the Fisher exact test, the Cochran-Armitage test for linear trend in proportions, the Kaplan-Meier survival curves, and the time-adjusted Cox and Breslow tests.

10. BEHAVIORAL SCIENCE

The Relationship Between the Health Care Environment and Human Behavior

Arranged by DEVRA LEE DAVIS (EPA, Washington, DC)

Mon., 13 Feb. / Shoreham / Tudor

9:00 a.m.-12:00 m.

What Do We Really Know About Color In Medical Facilities-A Status Report. BRIAN PIERMAN(National Bureau of Standards)

Can it be concluded at this time, that color and associated sources of light have even a marginal effect on the success of our medical facilities? More than anecdotal evidence now exists confirming that physiological change takes place in animals and humans, when subjected to selected color and wavelengths of light. Likewise, research underway leads to the quantification of human reaction to light and color, when presented in full-scale room environments. This paper reviews the evidence to date, in an effort to summarize the scope of our understanding of color used in medical diagnosis, medical treatment, and in providing a continuous and effective healing environment. Recent changes of attitude regarding the role of medical facilities for preventive medicine, both mental and biological, further exemplify the need to examine the health care environment as a whole, and to enhance the effectiveness of facilities through the proper use of color.

Recent Innovations in Design and Lighting for the Health Care Environment. ALEXANDER F. STYNE (University of Miami)

People, including physicians and nurses, have discovered that they cannot always and implicitly trust their color judgment based on memory. Color rendition as function of the spectral composition of light is related to the use of surface color forming the visual background against which patients' color must be judged as a warning signal for certain changes in their condition. Studies of light sources leading to the best assessment of changes in skin coloration have been undertaken on both sides of the Atlantic and are continuing.-Space design, surface colors and lighting are used with the awareness that they influence the emotional and mental reactions of patients to their environment. Recent studies of the influences of visual and spatial elements on user reactions are reported.- Actinic effects as by-product of many light sources have been scrutinized for some years. The controversy over benign and adverse effects of near UV radiation is reported, based on the latest available information.

Rennovation for a less Stressful Health Care Environment. GLORIA WEISSBERG (Gloria Weissberg Assoc)

The esthetics of a health care environment play an effective role in the experiences of patients, visitors, health care professionals and staff, particularly with respect to lessening stress. Some slides will be presented of facilities where environment was developed to reduce stress for patients and hospital staff, encourage feelings of well-being for patients and develop work pride for hospital personnel. Other slides will illustrate design of multi-purpose spaces, custom furnishings and coordinated super-graphics art work and signage. An approach to rennovating old facilities will be discussed with work flow charts, demonstrating how integration of design can be achieved with long range planning without the increase in expected yearly expenditures. Stress reducing environments can be economical, supportive of people in health care facilities, and designed for design's sake as well.

Toward a Theory of the Health Care Environment. DEVRA LEE DAVIS,

Until quite recently, health care designers, hospital planners, architects, educators, engineers, social scientists, physicians and allied health professionals have each worked on human health from their distinct frames of references, not recognizing that today's health requires explicit linkages between them. This failure to integrate methods stems primarily from the outmoded medical model which gave physicians primary responsibility for controling and erradicating infectious diseases; relegating all others to lesser roles. Infectious diseases are no longer the leading causes of death and disease, having been supplanted by lifestyle related problems. Recent epidemiological studies indicate that today's health to a great extent reflects the physical environment, the workplace, and life-style factors such as social class, nutrition and exercise. Within the health care environment itself, in-door pollution, lighting, design, color and in-house information programs are integral to any attempt to promote health and prevent diseases. The national policy of eliminating unneeded hospital beds will require rennovation and re-allocation of hospital space; such efforts should be mindful of the relationship between the total health care environment and patients' health.

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Language Rehabilitation in Aphasia: An Examination of the Process and Its Effects

Arranged by CHRISTY L. LUDLOW (NIH)

Mon., 13 Feb. / Shoreham / Tudor

3:00 p.m.-6:00 p.m.

Veterans Administration Cooperative Study on Aphasia: A Comparison of Individual and Group Treatment. RT WERTZ (VA Madison), RH BROOKSHIRE (VA Minneapolis), MJ COLLINS (VA Hosp Madison), T FRIEDEN (U New Mexico), J KURTZKE (VA Washington DC), J PIERCE (VAH New Orleans), D WEISS (VA Perry Point)

The Veterans Administration Cooperative Study On Aphasia was designed to compare individual and group treatment of aphasic patients who have suffered a left hemisphere cerebral vascular accident. Patients who meet selection criteria were assigned randomly to either traditional, individual language therapy or group therapy in which there was no direct manipulation of language deficits. All patients received eight hours of treatment each week beginning at four weeks post onset and continuing to 48 weeks post onset. Results show that both individually and group treated patients obtained significant recovery from aphasia. Individual treatment resulted in significantly better overall performance on the Porch Index of Communicative Ability. No significant differences between groups were noted on five other measures of speech, language, and problem solving. If the traditional belief that spontaneous recovery from aphasia terminates at three to six months post onset is correct, continued recovery in our patients beyond this period may be interpreted as evidence that both individual and group therapy are efficacious methods for managing aphasic patients.

Recording Behavioral Events in Aphasia Treatment. R.H. BROOKSHIRE (Minneapolis Veterans Administration Hospital)

A system has been developed for coding and recording behavioral events which occur within language rehabilitation treatment sessions involving aphasic individuals and speech pathologists. The system is based upon a model which views the basic component of the treatment interaction to be the sequence -- clinician request for response - patient response-clinician feedback. Clinician requests can be categorized according to type, manner of presentation, and complexity. The presence of treatment materials and response support by the clinician can also be recorded. The nature of the response expected from the aphasic individual, the characteristics of the aphasic individual's response, and the consequent behavior of the clinician can be recorded. The system has demonstrated its reliability in recording interaction events within both live and videotaped treatment sessions. Its use in analyzing samples of treatment gathered from around the United States has demonstrated that there appear to be quantifiable differences among what speech pathologists do in aphasia treatment, and that, in many cases, speech pathologists can be assigned to groups with common approaches to treatment. In addition to description and categorization of treatment philosophies and techniques, the interaction analysis system makes possible examination of functional relationships among the clinician's behavior and the aphasic individual's behavior, his improvement within the session, and his recovery over time.

Observing and Quantifying Functional Communication in Aphasic People. AUDREY L. HOLLAND (University of Pittsburgh).

The communicative behavior of eighty aphasic people was observed over a period of four hours in each patient's natural living environment. Thirty-eight aphasics lived in chronic-care settings; forty-two lived at home. They represented a range of aphasic syndromes and levels of severity. This paper will discuss the types as well as the frequencies of communicative acts observed, and explore the effects of living environment upon the observed behavior. The paper will relate the observed communicative behavior to presenting aphasic syndromes. Finally it will relate observed behavior to performance on tests traditionally used to evaluate language skills in aphasia and to a new test instrument designed to assess functional communication of aphasic patients in daily living.

Criteria for Selecting Aphasic Patients for Melodic Intonation Therapy. NANCY A. HELM (Boston Veterans Administration Hospital)

Aphasic patients with severe paucity of propositional speech are often unresponsive to traditional therapies. In contrast, a new procedure, called melodic intonation therapy, produced dramatic improvement in the first three patients treated. This procedure utilizes high probability phrases which are musically intoned according to the inflection, stress and rhythm patterns of normal speech, and are embedded in a highly structured program. Further experience with melodic intonation therapy revealed that while the majority of patients made notable speech gains, a significant number did not respond. These puzzling findings motivated the present study which seeks to establish, retrospectively, better criteria for selecting candidates. Scores obtained on the Boston Diagnostic Aphasia Examination prior to therapy were examined. The best predictor of successful response proved to be the inability to repeat single words. Other significant predictors are presence of severe oral apraxia, and restriction of spontaneous output to a phonemic stereotype. Success is also affected by etiology and duration of deficit.

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Brain and Behavior: Mechanisms of Perception, Learning, Memory, and Attention

Arranged by DONALD B. LINDSLEY (Univ. of California, Los Angeles)

Tues., 14 Feb. / Shoreham / Palladian

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Plasticity in the Visual System of the Golden Hamster. LEO M. CHALUPA and ROBERT W. RHOADES (Department of Psychology, University of California, Davis 95616).

The functional organization of the superior colliculus in the golden hamster was investigated in normal animals, those subjected to either visual deprivation or restriction, as well as in animals which underwent unilateral aspiration of visual cortex in infancy. In terms of the environmental manipulations, it was found that visual experience was not necessary for the induction or maintenance of normal receptive field properties. However, rearing in a stroboscopic environment altered the response characteristics of visual cells in the superior colliculus. These results indicate that the system has a strong genetic basis (as compared to the cat) in that it developes relatively normally without visual experience. At the same time, an aberrant visual input can disrupt this organization and perhaps induce some adaptation at the neuronal level. With regard to the effects of neonatal cortical lesions, the changes in functional organization were similar to those observed when such damage was induced in adult animals. However, in the neonatally lesioned hamsters there was a significant increase in the number of collicular neurons which could be activated by stimulation of the contralateral visual cortex. These findings suggest that the anatomical plasticity which has been demonstrated in the corticotectal projection of the rodent, while having clear physiological concomitants, may be of relatively little importance in the organization of the visual receptive field characteristics of superior collicular cells.

Cortical Mechanisms of Visual Acuity and Form Discrimination in the Cat. JAMES M. SPRAGUE (Univ. of Pennsylvania) and MARK A. BERKLEY (Florida State University)

Many aspects of visually guided behavior in the cat show minimal deficits after removal of areas 17-18 (Doty 1971; Sprague et al. 1973). These include visual attention, orientation, tracking, spatial localization, flux, pattern and many form discriminations. Since these complex tasks failed to reveal the role of the striate cortex in visual perception, we selected stimuli in which only one cue was relevant and performance was measured using a threshold testing procedure when this cue was varied. Specific tests were selected which might be related to special properties of neurons in area 17 (small receptive fields, tightly tuned for orientation specificity, showing fine-grained retinotopy). Thus, cats were trained in 1) grating acuity (size), 2) orientation acuity (angularity), 3) contour alignment (vernier offset)before and after removal of areas 17-18. Postoperatively, deficits varied from modest (25% elevation of threshhold in gratings, reduction of acuity equivalent to change from 20/20 to 20/30, to moderate (three-fold increase in angularity threshold), to marked (minimum increase of 10-20-fold in vernier offset). None of these functions was significantly altered by large lesions outside of areas 17-18. Our results indicate that cats can discriminate spatial stimuli without use of non-form cues (local flux cues, etc.) after loss of areas 17-18. In such animals, deficits occur only when a dimension of the stimuli approaches the acuity limit. (Supported by PHS grants EY 00953 and 00577).

Comparative Anatomical and Behavioral Studies of the Tecto-Pulvinar System in Tree Shrew and Bushbaby. IRVING T. DIAMOND (Duke University)

The tree shrew and bushbaby may represent stages in the evolution of the tecto-pulvinar system. In tree shrew the entire pulvinar nucleus receives a visual projection from the superficial layers of the superior colliculus (SC) and in turn projects to an extensive cortical area from the border of area 17 to the auditory cortex. In bushbaby only a portion of the pulvinar receives projections from SC and only a portion of the temporal lobe is the target of this extrinsic subdivision of the pulvinar. The remaining parts of the pulvinar of bushbaby, however, also receive visual input, but from area 17 of cortex and not from brain stem. This projection to pulvinar from area 17 arises from pyramidal cells of layer V and may consist of collaterals of axons which project from area 17 to the superficial superior colliculus. The pulvinar of bushbaby also receives a reciprocal projection from the temporal cortex--these fibers originate in layer VI of the temporal lobe while layer V of the temporal lobe projects to the deep layers of SC. In both tree shrew and bushbaby the deep SC receives projections from the somatic and auditory belt cortex as well as from the visual belt. Thus, the tecto-pulvinar is closely interlaced with the geniculo-striate system by descending projections.The subdivision between the superficial and deep layers of the SC is underlined by differences in connections and functions. Ablation of the deep superior colliculus results in profound inattention.

Vision With Eye Movements: Attention, Anticipation, and Suppression in Monkey Superior Colliculus. ROBERT H. WURTZ (National Institute of Mental Health) Bethesda, Md. 20014.

The retina sends a barrage of visual signals to the central nervous system during rapid eye movements from one part of the visual scene to another. A striking finding in recent years has been that a brain stem visual area, the superior colliculus (SC), exerts active control over this massive visual input rather than passively responding to it. Cells in the superficial layers of the monkey SC all respond to visual stimulation. But they respond more vigorously and more regularly if the awake monkey is using the particular target for a saccadic eye movement. This enhanced response relates to anticipatory discharge of cells related to eye movements which exist in deeper layers of the SC and is an example of a case where the monkey's anticipation of a stimulus appears to modify the response of the visual system to the stimulus. Visual cells in the colliculus are suppressed when the stimulus is irrelevant, that is, they are insensitive to the sweep of the visual field as the eye moves to a new visual target. This suppression has now been demonstrated to be a corollary of the oculomotor discharge producing the eye movements, not a result of peripheral feedback. Finally, the visual activity acts as a gate on many of the eye movement cells in the colliculus: some of these movement cells respond before eye movements but only if the movement is made to a visual stimulus. None of these visual motor interactions have been observed in the striate area of visual cortex.

The Interaction of Central Commands and Peripheral Feedback in Regulation of Volitional Movement. EDWARD V. EVARTS (National Institute of Mental Health).

The precentral motor cortex in the primate receives both thalamo-cortical and cortico-cortical inputs, with the heaviest cortico-cortical projection arising in the postcentral gyrus (PCG) and the heaviest thalamo-cortical input arising in nuclei ventralis lateralis (VL) and ventralis anterior (VA). The VL-VA input becomes active prior to movement onset (carrying a central command) while the PCG input becomes active following movement onset (providing afferent feedback from skin, joint, and muscle receptors). Once a movement is in progress, these two sources of input converge on the efferent pyramidal tract neurons (PTNs), such that PTNs (whose axons descend from motor cortex to spinal cord) are summing points in a transcortical servo loop. As a result of this loop, a "mismatch" between intended and actual movement will give rise to a PTN signal which will tend to reduce the mismatch. Studies in monkeys have shown that peripheral inputs are especially effective in controlling PTNs during the precise movements for which motor cortex integrity is so essential. In addition to exciting alpha motoneurons, motor cortex outflow via PTNs can excite gamma motoneurons and heighten the sensitivity of the muscle receptors in the servo loop. It thus appears that motor cortex has the capacity to optimize the sensitivity of the elements mediating the "transcortical servo" proposed in 1969 by Phillips.

Central Neural Mechanisms for Directed Attention. Vernon B. Mountcastle, Johns Hopkins Un.

The parietal association cortex of primates is part of a cerebral mechanism for directed attention. It generates commands for attention to and shift from one target to another, and for coordinated actions of hand and eye. These conclusions are drawn from studies of parietal lobe neurons made in monkeys trained to fixate, track, or saccade to targets of interest. Four major classes of neurons were identified. The first is light sensitive in the traditional sense. Three major classes are visuomotor in a special and conditional sense. Their activity increases during steady fixations or movements of the eyes which secure and maintain foveation of objects, but only if those objects have a motivational link for the animal, here one between thirst and the target light, whose dimming the animal has learned he must detect for liquid reward. The properties of these ensembles of parietal neurons appear as positive images of the attentional, visuomotor, and visual perceptual defects that appear in primates after parietal lobe lesions. The results will be considered in the context of a more general theory of the functional organization of the neocortex.

Disorders of Attention in Human Focal Brain Lesions. NORMAN GESCHWIND (Harvard), MAREK-MARSEL MESULAM (Harvard)*

In animals inattention is found to stimuli in all modalities on the side opposite a lesion in several sites. Unilateral inattention in humans differs from the animal syndromes in showing a major cerebral dominance effect. Severe persistent inattention involves predominantly the left side of space. The lesion is usually in the right inferior parietal lobule. Reasons will be given for rejecting the view that left unilateral inattention depends on right brain dominance for spatial functions. Our alternative hypothesis: 1) The right hemisphere is dominant for attention, i.e. it receives information from both sides, initiates scanning of areas from which little information is coming, contains criteria for shifting the center of awareness. 2) Following a right brain lesion the left brain may recover attention to its own (right) side of space, but cannot assume the full dominance function. Confirmatory data from unilateral lesions, callosal lesions, and normals will be presented. Recent studies of the cortical afferents of the rhesus inferior parietal lobule show major inputs from 1) areas which themselves receive afferents from multiple sensory association areas 2) limbic cortex of the cingulate gyrus. The importance of these highly filtered inputs and of limbic input for attention is discussed, as well as the possible basis for human right hemisphere dominance.

*Supported in parts by grants from NINCDS, The Scottish Rite Foundation, and the Beth Israel Hospital.

Selective Perceptual and Memory Disorders in Humans with Focal Lesions. BRENDA A. MILNER (Depts. of Neurology and Neurosurgery, Montreal Neurological Inst. & McGill U.)

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New Light on Leadership Processes

Arranged by EDWIN P. HOLLANDER (State Univ. of New York, Buffalo)

Wed., 15 Feb. / Shoreham / Forum

9:00 a.m.-12:00 m.

Contingency Oriented Leadership Training. MARTIN M. CHEMERS (Dept. of Psychol., Univ. of Utah, Salt Lake City).

In the last 10 to 15 years, leadership theories have largely taken a "contingency" orientation, in which person, process, and situation are integrated to predict leadership outcomes, e.g., group performance, follower satisfaction, and group structure. This shift represents a dramatic improvement over earlier trait dominated approaches and has accelerated leadership theorizing and research, as well as practical applications. Most contemporary leadership theories focus primarily on behavior, structure, or interaction process while, to some extent, neglecting the role of a person's values, attitudes, and dispositions. Although there were excesses in the earlier "universal leadership trait" approaches, and there are difficulties in defining and measuring complex attributes of human personality, the person remains a central aspect of the leadership process. The qualities that he or she bring to the leadership situation are still of great importance. The present paper explores recent research and theorizing concerned with the explication of a measure of leadership orientation or style, called the LPC construct. Data are reported which shed light on the psychological processes which give rise to particular leadership orientations, and on the resultant behavior and performance. A new technique for inferring aspects of group process and information exchange is discussed. Finally, the implications of contingency approaches are related to attempts to train leaders. The role of person, process, and structure are examined as components of leadership training.

Role-Making Processes of Leadership Development. GEORGE GRAEN (College of Bus. Admin., Univ. of Cincinnati).

In this paper leadership is viewed as a process involving leaders, followers, and a network of interrelationships which function within environmental settings to produce increments in reciprocal influence over and above that produced by institutional authority mechanisms. Viewed in this way, leadership is a state of a leader-follower system of social exchanges and interpersonal relationships. This system is seen as developing within an environmental setting or situation as a function of the combined characteristics of actors, their behaviors, and the social context as enacted within a role-making scenario. Such a scenario consists of the behavioral exchanges of a leader and a follower as they work through agreements on how each will behave in various situations and as they work to establish the parameters of their relationship against the backdrop of the ongoing enterprise. A model describing a number of important properties of role-making processes of leadership development and some empirical evidence are presented and discussed.

Leadership Dynamics: A Transactional Perspective. EDWIN P. HOLLANDER (Dept. of Psychol., State Univ. of N. Y. at Buffalo)

Leadership is a process of influence which involves an ongoing transaction between a leader and followers. The key to effective leadership is in this relationship, built over time. Although most attention is given to the leader, leadership depends upon more than a single person to achieve group goals. Followers as well as the leader are vital to understanding leadership as a process involving the potential for change. However, the greater tendency in viewing leadership has been to accept the leader and followers in fixed positions. The transactional approach is a way of describing leadership in more dynamic terms, taking account of followers' expectations and perceptions. An exchange occurs in which benefits are traded between the leader and followers so that the leader gives something and gets something. The precise nature of those benefits is not as important as the recognition that the leader is a resource from whom adequate role behavior is expected. The leader is expected to provide competence in the main task, and fairness in dealings with others, among other qualities. In return, the leader receives the greater influence which usually goes with status, recognition, and esteem. These are part of a leader's perceived legitimacy in exercising authority, which is central to the effectiveness of leadership.

Relating Concepts from the Path-Goal and Charismatic Leadership Theories. ROBERT J. HOUSE and MARTIN G. EVANS (Faculty of Mgt. Studies, Univ. of Toronto).

Two theories of leadership have recently been advanced that have as the dependent variable the motivation of followers. These theories are: a) the Path-Goal Theory of Leadership (Evans, 1970; House, 1971; House and Mitchell, 1974) and b) Charismatic Theory (House, 1976). The two theories hypothesize different classes of behaviors by which the leader effects the motivation of followers. These classes of behaviors are termed instrumental leader behaviors and charismatic leader behaviors. These different behaviors are not in conflict, but rather appear to be complementary. That is, an effective leader may engage in either class of behaviors or in both classes of behaviors. This paper describes the two theories and their hypothesized behaviors and compares and contrasts the effects of leaders who engage in each. Speculations are advanced about various combinations of these two classes of leader behaviors. Finally, speculations are advanced about the conditions under which the leader behaviors specified in the two theories will be most motivational for followers.

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Executive Development and Stress from the Psychoanalytic Point of View

Arranged by LOUIS A. GOTTSCHALK (Univ. of California, Irvine)

Wed., 15 Feb. / Shoreham / Forum

3:00 p.m.-6:00 p.m.

Some Developmental Roots of Leadership. ALBERT J. SOLNIT, M.D. (Yale University Child Study Center).

At birth, the child is helpless to survive without the care of an adult. In surviving, the child's response to the care-taking adult or adults involve child and adult in an interacting mutuality. In this mutuality, the infant survives to reassure the parent of his or her competence. At some inarticulate level, parents in asserting this competence also affirm their need and wish as adults, to be in control and to ward off fear of helplessness. This fear is universal and lifelong and originally was set in motion by the child's physical helplessness at birth. When the child is helpless, i.e., dependent, the parents serve as the nurturer, protector, regulator, buffer and lawgiver for the child. As the child matures, if the parenting and other aspects of the environment are in a positive balance, the child develops into an increasingly active, independent and socialized human person. The parent, as leader and auxiliary ego for the child, is a model with a significant and continuing influence on the child as he becomes adolescent and adult with a variety of executive potentials and capabilities. How the child moves from passive to active, from dependent to independent, from asocial to social and from follower to leader in personality development, is the focus of this presentation. The helplessness of the newborn child foreshadows the development of human personality with a large repertoire of executive capacities and leadership as well as followership patterns.

Can Psychoanalysis Contribute to Our Understanding of Executive Development, Executive Functioning and Executive Stress? GEORGE H. POLLOCK, M.D. (The Chicago Institute for Psychoanalysis).

On the basis of experience in conducting courses and seminars for chief executive officers and business executives, the author has been able to delineate those aspects of psychoanalytic theory which seem to be of significance and importance to executive development, functioning, and the handling of stress-strain. In the presentation some of these will be briefly presented and, if time allows, there will be examples and vignettes given to illustrate the applicability of psychoanalytic principles that are important beyond the clinical application. Psychoanalysis is a body of various theories,

each of which should be considered separately even though it comes under the general designation of the science. Among considerations to be kept in mind are: (1) a theory of unconscious internal psychic functioning; (2) a theory of personality development; (3) a theory of pathology as a deviation from the norm; (4) a theory of treatment; and (5) a theory which can be applied to our understanding of literature, art, music, etc. These different theories of psychoanalysis will be related to the central theme.

Maternal Identification in Executives. GENE GORDON, M.D. (The Baltimore-District of Columbia Institute for Psychoanalysis).

Executive leadership in the Western nations has traditionally been regarded as a masculine set of attributes, and it is not surprising that psychoanalytic discussions of leadership have tended to focus on the developmental vicissitudes of masculine libidinal and aggressive patterns. The executive leader as pastor, shepherd and the stresses visited upon him by virtue of his flock's needs for love, support, therapy, and emotional sustenance are the stuff of ancient legend and history. The character traits which enable the executive to meet these demands are essentially maternal in origin and pattern. This thesis is supported by interview material from clinical and non-clinical sources relating to the nurturant function of the executive. Some family constellations which might facilitate the development of such ego capacities are discussed.

Humanization of Assessment: A Cybernetic Approach to Mental Health

Arranged by MARK N. OZER (George Washington Univ. School of Medicine) and FRANK BAKER (State Univ. of New York, Buffalo)

Thurs., 16 Feb. / Shoreham / Board

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Issues of Quantifying Human Resource Development
CURTIS P. MCLAUGHLIN (University of North Carolina at Chanel Hill)

Human resource development has generally been evaluated by comparing benefits to costs. Benefit measures may be societal, organizational or individual. The first two types emphasize external values and productivity. Individual valuations tend to be based on preferences and utilities which one assumes constant. Yet mental health by its nature involves changing such perceptions. It is such changing perceptions as well as behaviors that might provide the feedback necessary to evaluate mental health self-help programs. The literature suggests a number of direct ways of looking at this problem including changes in income, job turnover, job satisfaction, equity, and locus of control. Another approach would emphasize using improvements in perceived well-being and future economic expectations that occur as income surrogates, measuring what income level changes would produce the same modifications in perceptions. Problems with such an approach include availability and reliability of data, value differences over whether the individual or the society should adjust, and a bias in the U.S. society toward valuing production over consumption and well-being as individuals and as a society. There are sufficient questions about the directions of causation in the interactions between economic well-being and attitudes that only a field test is likely to be convincing to the government or the scientific community at large. The preventive approach, estimating costs of social problems, is a third traditional alternative.

Knowledge Based Information Systems in Mental Health.
EUGENE LASKA (Rockland Research Institute)

Among a variety of computerized applications developed by the Multi-State Information System to measure the effectiveness of health care and to monitor the proper delivery of health care, one of the most recent has been the Medication Order Review and Exception System (MORES). In this system, outstanding drug orders are periodically reviewed and those which are in violation of a standard set of "questionnable practice rules" are automatically flagged, and a notification sent to the ordering physician. The rules that are entered are determined by a committee for each facility, which in a sense, act legislatively in deciding on a formalization of knowledge concerning drug treatment. (The physician of course is free to ignore the notification so long as he has reason to do so and the reason is well documented.) MORES provides a working illustration of a new development in the field of automation in medicine: the attempt to formalize, organize and enumerate knowledge within a computer data base and to bring such knowledge to bear at appropriate points in the therapeutic process. Questions to be addressed during the development of such a knowledge-based system include: How rigid should the rules be? Should they be easily amended within the system? How should feedback be handled? In what form should the information be returned to the physician? Can a knowledge-based information system ultimately act as consultant to the physician? Should the information be sent to the patient? Can analogous systems be created to interact with the patient on a routine therapeutic basis?

A System for Human Resource Development.
MARK N. OZER (George Washington Sch. Med.)

Three levels of measureable outcomes will be described. First is the degree of accomplishment of their plans by patients as a product of treatment now reconceptualized as a series of planning sessions. These plans are idiosyncratic to the individual, time and place. Second level of outcome is the degree to which the patient carries out the process of planning in terms of exploring, selecting, specifying goals and resources. Such skills may be expected to increase as a result of feedback by the therapist of these measures. The ideas arising from such a process may be applicable to a number of different situations in the life of the person and will aid in the development of the therapist's ability to help others. These ideas are resources. Third level of outcome is the degree to which the patient is able independently to ask the questions used in the planning process. These questions as to concerns, what has gone well in the area of concern, what worked, and what are some goals provide a basic framework. The application of this specified planning system to a variety of type of problem will be described. The crucial aspect is both the awareness of the three goals of therapy by the professional and the concomitant feedback to the patient of the degree to which these outcomes are being achieved.

Conceptual Complexity as a Measure of Training Performance in Human Service Workers. MARY D. MOORE (State of North Carolina)

Conceptual complexity, as measured by a sentence completion test and problem oriented interview, provides data for establishing training content objectives and measuring trainee performance. In a five year study of over 500 human service workers, conceptual complexity was found to be significantly associated with job skill test scores, supervisor ratings and academic achievement. Workers and trainees improved their performance in counselling, crisis intervention, and problem identification when, through special training, they increased their ability to conceptualize alternatives with increasing tolerance for ambiguity. This study suggests approaches to trainee selection criteria, course methodology and training effectiveness measurement.

A Cybernetic Approach to Family Therapy. W. F. HOGG, M.D. (Division of Community Psychiatry, State University of New York at Buffalo).

Family therapy is a clinical orientation that affords a unique view of human behaviour. As the primary suprasystem to the individual and a critical infrasystem to enveloping society the family is the most significant of intermediate variables. Over the years family therapy has become encrusted with diverse techniques whereby most therapists artfully but uneconomically "fly by the seat of their pants" from session to session. Compounding this, a consistent approach to diagnosis of family systems is lacking. This paper is an attempt to rationalize this neglected area. Within an overall framework of GST, the family can be viewed from the standpoints of several interdependent models. One involves the concept of a system of repeating sequences of communications via feedback loops between dyads and triads. Another is based on organized hierarchical structure of power and status. A third focuses on family development. Recognition of a continuum of exigencies (crisis theory) is another. The fifth premises certain fundamental family functions or purposes. Unrefined, these five models are clinically useless. My work has entailed the dissection and sequencing of them into a schema applicable either in the comprehensive survey of a total family or in a briefer elucidation of specific individual signals of dysfunction. The result, a family diagnostic profile consisting of numerous distinct but not mutually exclusive themes, is essential to sensible ongoing treatment planning.

Making Program Evaluation Valuable to the Program Being Evaluated. FRANK BAKER (SUNY Buffalo).

Increasingly, human service programs are being held accountable to government funders, third-party payers, regulatory agencies, and citizen-consumer groups. A major accountability mechanism is program evaluation which is usually more oriented to the informational needs of these external constituencies than to the needs and interest of members of the program system. Often staff are required to complete evaluation forms which are poorly designed, perhaps redundant, and about which they may never have any feedback as to specific results of data analysis. Over time, compliance with the provision of necessary information for program evaluation may suffer and program staff and administration may provide data to program evaluators which has little reliability or validity. Several steps can be taken to increase compliance with program evaluation by members of the program. One way of making program evaluation valuable to the program itself is to focus on questions which are of concern to the program and to feed back evaluation information in such a way that program personnel can engage in self-regulation and control which enhances program accomplishment and growth. This paper discusses the ways in which program evaluation can be carried out so as to provide valued information for decision-making by the management and staff of the program system.

Why doesn't Congress pay attention to history? MURRAY LEVINE (SUNY Buffalo)

Given that public almshouses and the like were terrible places, in 1935 Congress barred Social Security payments to their inmates. An unregulated nursing home industry was created. In 1965, Medicaid stimulated growth of a private, for profit nursing home industry, and other provisions of the act were used to support the mentally disabled and indigent elderly in wholly unregulated facilities. In 1972, Congress attempted to correct some abuses that had surfaced. However, the Supplemental Security Income Program was used to place former institutional inmates into unregulated board and care homes. In all three situations scandalous conditions emerged. Concepts of historical periods and of progress blind us to continuities and to the recognition of intractable problems. Scientific and economic materialism emphasized the readily countable limiting the monitoring of human values to the outbreak of scandal. The research community has little access to scandalous situations in private agencies. Oversimplified advocacy, and the use of ideology to rationalize leads to inadequate analysis of complex problems, and little effort to identify or monitor unintended consequences. One cannot assume congruence between the law on the books and the law in action.

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Culture and Science: Comparative Receptions of Psychoanalysis in Western Countries

Arranged by JOHN C. BURNHAM (Ohio State Univ., Columbus)

Fri., 17 Feb. / Shoreham / Executive
9:00 a.m.-12:00 m.

The Reception of Psychoanalysis in Germany Before World War I. HANNAH S. DECKER (University of Houston).

Though Freud and many of his followers have stated otherwise, psychoanalysis was never ignored in Germany. The immediate response by German physicians, psychologists, and the well-educated public was quite varied, ranging from fulsome appreciation to sarcastic rejection. Laymen responded more favorably than any other group, with physicians following second; reaction was least favorable among psychologists. The factors usually cited to explain the negative responses to psychoanalysis in Germany are sexual prejudice, anti-Semitism, and critics' personal neuroses. But in addition there are many other circumstances that accounted for German resistance. The specific historical developments of psychiatry and experimental psychology were quite crucial, as were individual professional circumstances within each discipline. Moreover, Freud was regarded as a throwback to the days of Naturphilosophie, against which late 19th century scientists emotionally rebelled. Also, by virtue of their education, these men placed limits on human knowledge, believed that human nature was essentially inexplicable, and subscribed to a mind-body dualism. The result was a materialistic preoccupation, an organicist outlook, and a sanctification of laboratory science. The scientists' dualistic view of the world influenced them to regard the study of the human mind as unscientific, to view nature as stronger than nurture, and to believe that "sick" and "healthy" people stood literally poles apart. Psychoanalysis represented an integrated world view and its acceptance demanded a revolution in basic scientific outlook.

Psychoanalysis in France. Nathan G. Hale, (University of California, Riverside.)

Although Freud regarded France as hostile to psychoanalysis, its influence has been major. Since 1913 it has been seen as a systematic, generalized psychology resting on clincal data and philosophical assumptions. Physicians and intellectuals have been prominent in its diffusion. After small beginnings, it became a major psychology within French psychiatry after 1945; by 1966 perhaps one-fifth of French psychiatrists had psychoanalytic training. Beginning with a literary vogue in 1921-24, it has engaged the attention of important philosophers, and recently, some sociologists and historians. Its impact has been limited by the close organization of French medicine, the somatic orientation of psychiatry, the Wundtian tradition in psychology. It has suffered from association with German and American culture, the latter leading to wide pread press publicity in the 1950's. Identified with attacks on bourgeois morality, since 1950 it has come to seem conservative to those advocating radical changes in sexual mores.

The Reception of Psychoanalysis in Great Britain. STEPHEN Y. WILKERSON (Duke University).

The history of psychoanalysis in Great Britain differed in several respects from its development in the United States. Whereas a number of American centers of psychoanalysis became important, psychoanalysis in Great Britain was concentrated in London. The different positions of neurology and psychiatry in the two countries also influenced the development of psychoanalysis. Unlike the Americans, the British did not require analysts to be licensed M.D.'s. Finally, personalities were probably more important in Great Britain than in the United States. Freud lived his last year in England; his presence there and later that of his daughter Anna were of great significance. The most important influence, however, in the early development of psychoanalysis in Great Britain was that of Freud's biographer, Ernest Jones. In the mid-twenties Jones was responsible for the arrival from Berlin of the controversial analyst Melanie Klein who greatly influenced the subsequent development of the British Psycho-Analytical Society. Organized psychoanalysis in Great Britain began with the founding of the London Psycno-Analytical Society in 1913. The British Psycho-Analytical Society was established in 1919. Its development was marked by the arrival of Melanie Klein in 1926, a report on psychoanalysis by the British Medical Association in 1929, the immigration of European analysts during the early 1930's, and the arrival of Freud and his family, the beginning of the Second World War and Jones's retirement as president in the late 1930's.

The Reception of Psychoanalysis in the Netherlands Ilse N. Bulhof (University of Texas).

The intellectual climate of the Netherlands- a middle class society was favorable for reception: in 1887, psychotherapy had been introduced; interest in functional neuroses was growing; novels discussed the unconscious, dreams, sexual problems. Van Renterghem (Amsterdam Institute for Psychotherapy) and Jelgersma (Psychiatry, University of Leiden) easily accepted psychoanalysis. Leiden- the most liberal of the Universities- became its stronghold. Other Universities remain neutral. From 1914 on, the discussion widens. Protestant circles began to formulate responses. Roman Catholic responses came later. Socialists were not interested, however. In 1917, the Dutch section of the International Psychoanalytic Association was founded. In 1921, Freud was offered the honorary membership of the Dutch Association of Psychiatrists and Neurologists. Jung had considerable influence, making it possible for religious persons to accept much of Freudian analysis. Psychoanalysis was not used as a political weapon. It largely remained a scientific matter.

Spain. THOMAS F. GLICK (Boston University).

The reception of psychoanalysis in Spain in the 1920's and 30s is considered in the light of contemporary assessments by two Spanish non-Freudian psychiatrists, one asserting that Freudian psychology had impacted primarily upon medical and psychological theory, the other claiming that the major impact was upon clinical practice and the doctor-patient relationship. Reception of Freudian ideas in the Spanish medical community (psychiatry, neurology, and physiology) was apparent well before 1920, but a profound penetration occured with the publication of the Obras completas of Freud, beginning in 1922, the first such project in any language. It was through this translation that Freudian ideas reached non-medical intellectuals, with particular resonance in the areas of feminism, sexual reform, and male-female relationships.

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Cocaine

Arranged by LESTER GRINSPOON (Massachusetts Mental Health Center, Harvard Medical School)

Fri., 17 Feb. / Shoreham / Forum

3:00 p.m.-6:00 p.m.

History of Cocaine . DAVID F. MUSTO, M.D. (Yale University)

The history of cocaine will be traced beginning with its introduction to physicians as an ideal stimulant and hay fever remedy, later as a peripheral nerve blocking agent and surface anesthetic, to its frequent use in popular cola drinks and association with violent criminal behavior. The possible relationship between extremely punitive restrictions and alledged excessive use of the drug by feared minority groups will be discussed.

Coca and Cocaine as Medicines. ANDREW T. WEIL, M.D. (Botanical Museum of Harvard University).

South American Indians have used coca leaf as a remedy for thousands of years. In contemporary medicine, coca might be useful as a treatment for gastro-intestinal ailments and motion sickness, as a fast-acting anti-depressant, as a substitute stimulant for coffee in certain cases, and as an adjunct in programs of weight reduction and physical fitness. In leaf form coca does not produce toxicity or dependence. Coca can be administered as a chewing gum containing a whole extract of the leaf, including alkaloids, natural flavors, and several nutrients. As the principal alkaloid in coca, cocaine has been used for many therapeutic purposes also. Distinctions between coca and cocaine are considered, along with the advantages and disadvantages of each as medicines.

Use of Cocaine in Neurophysiological Models of Psychosis. ROBERT M. POST, M.D. (National Institute of Mental Health).

Anecdotal clinical evidence suggests that high dose cocaine abuse may lead to the development of a paranoid psychosis like that well documented following amphetamine and other psychomotor stimulants. Thus, the mechanisms involved in the behavioral disruption following long term cocaine administration in animals may help contribute to an understanding of the evolution of a psychotic process.

Although tolerance apparently develops to some effects of the psychomotor stimulants (cardiovascular and response suppressing effects), reverse tolerance or sensitiization may be observed in other parameters, such as hyperactivity, stereotypy, catalepsy, or seizures. Catecholamine, especially dopaminergic, mechanisms may underlie cocaine's progressive effects on activity, stereotypy, and catalepsy, while local anesthetic properties may also be involved in other bizarre behaviors and in seizure mechanisms. Many biochemical mechanisms on a pre- or postsynaptic basis, such as receptor supersensitivity, may be invoked to explain the sensitization process. In addition, characteristics of the cocaine syndrome may be usefully compared to the neurophysiological phenomena of kindling, in which repeated electrical stimulation, especially of the limbic system, leads to increased duration and spread of electrical activity culminating in full-blown seizures to a previously subthreshold stimulation.

Federal Policy on Cocaine. PETER G. BOURNE (The White House).

The steady increase in the use of cocaine has been a matter of serious concern for the federal government, posing complex policy considerations. Despite widespread use and the potential for severe health consequences it does not appear that at the present there are major problems occurring. At the same time the profits derived from trafficking are causing serious problems of corruption in Latin Countries and seriously undermining their economies. This paper reviews the overall policy of the federal government and the specific strategies for dealing with cocaine.

Drugs and Culture: Cocaine as a Historical Example. James B. Bakalar (Harvard Medical School).

In its long history as a medicine, stimulant, and intoxicant, different societies and different eras have classified cocaine in different ways. From this history we can learn something about the significance of drug use in various social contexts: primitive ritual and medicine, labor in colonial empires, and especially industrial society in a time of rapid technological and institutional change. For cocaine as for several other drugs, the late nineteenth century and the period since 1960 are decisive. By examining the changing background of coca and cocaine use, it is possible to explain in part why nonmedical use of psychoactive drugs generates such strong passions and controversial public policies in modern industrial societies.

11. HUMAN DEVELOPMENT AND HABITATION

Aging from Birth to Death

Arranged by MATILDA WHITE RILEY (Bowdoin College)

Mon., 13 Feb. / Shoreham / Palladian

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Life-Span Developmental Psychology, Cognitive Functioning, and Social Policy. PAUL B. BALTES (Pennsylvania State University), SHERRY L. WILLIS (Pensylvania State University).

The emerging field of life-span developmental psychology is briefly defined and placed in historical context. Second, data are presented from selected research programs on the relationship between social change and ontogenetic development in cognitive functioning, which have contributed to a major reconceptualization of the field of developmental psychology. This reconceptualization deals with (a) expanding the concept of development, (b) linking ontogenetic and biocultural mental constructs, and (c) linking ontogenetic and biocultural (social) change. These new perspectives permit the tentative formulation of some generic principles for social policy related to life-span development. In general, the perspective suggests a model of life-span development which involves ontogenetic discontinuity and much more plasticity in the individual life course, especially in adulthood and old age, than has been traditionally assumed. Such a view on life-span development also suggests opportunities for interventive and compensating action in the direction of optimization. Social policy on educational systems is used to illustrate implications derived from such a life-span orientation to the study of cognitive development.

The Complexity of Work and Intellectual Functioning. MELVIN L. KOHN (NIMH) and CARMI SCHOOLER (NIMH).

Our previous research, based on cross-sectional data, provided prima facie evidence of a reciprocal relationship between the substantive complexity of men's work and their intellectual flexibility. This study employs longitudinal data to make a more definitive assessment. Using maximum-likelihood confirmatory factor analysis to separate measurement error from real change, it develops measurement models for both substantive complexity and intellectual flexibility. These models show that, over a 10-year time span, the "stability" of both variables, shorn of measurement error, is high, that of intellectual flexibility especially so. Nevertheless, a structural equation causal analysis demonstrates that the effect of the substantive complexity of work on intellectual flexibility is real and remarkably strong--on the order of one-fourth as great as the effect of men's earlier levels of intellectual flexibility on their present intellectual flexibility. The reciprocal effect of intellectual flexibility on substantive complexity is even more pronounced. This effect, however, is not contemporaneous, but rather a lagged effect occurring more gradually over time.

Stressful Events of the Life Course. BRUCE P. DOHRENWEND (College of Physicians and Surgeons of Columbia University), JOHN M. DE FIGUEIREDO (College of Physicians and Surgeons of Columbia University).

A growing number of investigators have been finding that recent stressful life events are related to the onset of various types of physical illness, injury, and psychological disturbance. Typically, however, the relationships, especially in prospective studies, are not strong. This has led a number of researchers to focus on factors such as the nature of the events themselves and the personality and situational factors that may mediate their impact. In the process, however, little attention has been given to the possible part played by the relation of more remote events to the more recent events as these may influence outcome. In this paper, we report an investigation of the patterns of relations among major or "landmark" events, especially events involving losses, before age 18, and recent events in the preceding twelve months by members of a probability sample consisting of 167 adult residents of New York City. Our aim is to examine the possible role of remote events in bringing about more contemporary stressful life events and/or providing experiences that mediate adaptation to recent life events.

Aging and Social Support: An Alternative to the Disengagement Hypotheses. ROBERT L. KAHN (Survey Research Center, University of Michigan).

Disengagement theory postulates a reducing preference, need, and capacity for activity and interaction as age increases. Two major questions arise in connection with this formulation: (1) the extent to which reductions in interactive behavior actually occur with increasing age, and (2) the extent to which, if they do occur, they are sought or imposed. These questions are given a preliminary examination by means of an interview study of 132 adults, each of whom identified all other individuals with whom there was a pattern of giving or receiving social support. Results suggest that the fact of disengagement among older people has been somewhat exaggerated and that their preference for it has been grossly exaggerated. An alternative model is proposed, which predicts the well-being of the individual from the supportive transactions with a "convoy" of others. Such transactions are in turn predicted from the formal properties of the convoy (size, symmetry, stability, etc.) and from characteristics of the individual-(especially age). Differences in individual needs and preferences are taken into account by measuring preferred as well as actual levels of interaction. Individual well-being is maximized, according to this model, when goodness-of-fit is maximized between individual needs and convoy characteristics.

Social Support and Health Through the Life Cycle. SIDNEY COBB (Brown University Program in Medicine).

Social support or communicated caring is defined as information leading the subject to believe that he is 1) cared for and loved, 2) esteemed and valued, 3) a member of a network of communication and mutual obligation. It is usually reciprocated and belongs to the set of supports which include instrumental support (counseling), active support (mothering) and material support (goods and services).

Findings to be reviewed will include effects on the outcome of pregnancy, the outcome of hospitalization, the occurrence of asthma, arthritis, tuberculosis and coronary heart disease, the mental health of the aged and on those threatened with death.

Several possible mechanisms of action will be presented. It is believed with as yet only limited evidence, that social support is most likely to produce the described effects by facilitating adaptation, i.e., changing self to meet situtational demands and coping, i.e., changing the environment to fit personal needs. Both adaptation and coping are techniques for reducing the impact of social stresses.

Intrinsic and Extrinsic Sources of Change in Life Course Transitions: Lessons from Age-set Societies. ANNE FONER (Rutgers University), DAVID KERTZER (Bowdoin College)*

Underlying sources of change in life course transitions are probed through a comparison of transitions in two contrasting types of societies: African age-set societies, where age is a major and explicit element of social organization, and contemporary American society. We find that life course transitions, those key points in the aging process when individuals give up old roles and take on new ones, are subject to change in both types of societies: first, because of problems intrinsic to transition processes and, second, because of pressures from external events. On the one hand, the very rules of transition give rise to social conflict and tensions and these, in turn, create pressures to change transition practices. On the other hand, external forces, changed in the physical and social context in which transitions take place, lead to alterations in transition procedures. Thus whether societies are marked by a slow or a rapid rate of social change, life course transitions--and therefore the aging process--are rarely the same for successive cohorts.

*The research for the study was supported by a grant from the Russell Sage Foundation's Program on Age and Aging.

Changes in the Transition to Adulthood. H. H. WINSBOROUGH (University of Wisconsin).

This paper investigates the way cohorts of males have moved through those life cycle transitions which constitute the progression from school boy to married adult. It shows that recent cohorts have moved through this progression much more rapidly than did earlier born ones. The paper then proceeds to discuss how this reduction may have come about in the Post World War II period. The total transition is discussed as the convolution of a sequence of transitions involving completing school, taking a first full-time job, entrance to and exit from the Armed Forces and entrance into first marriage. Most of the changes in the age at first marriage distribution are accounted for by changes in the completion-of-education distribution and the processes involved in Armed Forces participation. The paper concludes with the conjecture that a similar process might explain some portion of the post-war baby boom.

The Impact of Demographic Change Upon Three Generations of Old People. PETER UHLENBERG (The University of North Carolina, Chapel Hill).

The composition and character of a cohort of individuals entering into old age at any point in time reflects the cumulative effect of a vast array of social, economic, political and biological events that occurred earlier in history and impinged upon the cohort as it occupied various stages of the life course. This paper traces the cumulative impact of changes in major demographic variables (mortality, fertility, marital formation and dissolutionment, immigration, and urbanization) upon three birth cohorts at the time each is beginning the last stage of its life course. The cohorts selected for attention are approximately three successive generations (birth cohorts of 1870-74, 1900-04, 1930-34) which are entering old age around 1940, 1970, and 2000, respectively. The changing nature of old age in America, as determined by the interaction of particular cohort composition and the surrounding socio-demographic environment existing at that time, is discussed. Special attention is given to the need to redirect gerontological policy in response to changes that will occur over the next several decades.

Inflation, Unemployment, and Who Can Afford to Retire? JAMES N. MORGAN (The University of Michigan).

Economic factors and health dominate people's decisions when to retire, and their satisfaction when they do. Yet we know very little about the provisions for retirement of individual households. Studies of the distribution of wealth are rare, and do not include rights in retirement programs. What little evidence there is points to wide disparities, verging on bipolarization. A recent small reassessment of retirement plans and expectations reveals unexpected non-linear age patterns that did not exist ten years earlier. One possible explanation is the differential historical experience of succeeding generations. The generation closest to retirement got seniority before the unemployment of the sixties hit, while asset values were still rising. Later generations hit the job market with the rest of the post-war baby boom, and competed with older women entering the labor market. They are, given their ages, less likely to look forward to early retirement. We were unable to test this because people were so uncertain about what retirement income they could expect. Hopefully that uncertainty was a temporary result of scare stories about Social Security and pension funds plus the unfinished changes in private pension plans. More research is needed.

Prospects for Aging in America. THEODORE J. GORDON (The Futures Group, Glastonbury, Connecticut)

Life expectancy at birth has increased 24 years since 1900; however, improved life expectancy at advanced age has progressed slowly. Two lines of research promise to improve life expectancy at advanced ages. The first is squaring of the survival curve. Technologies in this class include improved disease control. The second, span extending, involves the direct attack on the process of aging. Only the former technology is likely to affect the demography of our country and the world within the next 50 years. Important social and economic consequences will flow from these trends. Retirement age should increase because of economic pressures on social security and private pension funds; improved education of the elderly; the desires of the elderly themselves to work; attitudes toward mandatory retirement; etc. Delaying retirement will have the effect of decreasing the dependency ratio; however, providing jobs for the increased labor force will remain an unresolved problem. We suspect that new employment modes will come into being: sabbaticals, job sharing, increased part-time employment, new work status, etc. Changes in health care costs depend on the strategy used to obtain "curve squaring." A disease-prevention strategy is likely to be less expensive than a therapeutic strategy. Other effects of this shifting demography will occur in the areas of politics, new family considerations, changes in insurance practices, etc. The research reported in this paper was accomplished under contract to the National Science Foundation/RANN.

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Emotional Development in Infants

Arranged by DAVID PEARL (Natl. Institute of Mental Health, Rockville, MD)

Tues., 14 Feb. / Shoreham / Forum

9:00 a.m.-12:00 m.

Emerging Models of Emotional Development in Infancy; From Social Expressions to Psychological States. ROBERT N. EMDE, M.D. (University of Colorado Medical Center.)

Now that the infant is appreciated as being fundamentally active, socially interactive and organized, it is a significant challenge for researchers to conceptualize organized complexity as it increases. This paper will propose new models based on recent research in infant emotional development. The first model represents two shifts in biobehavioral organization, one at two months and another at 7-9 mos. Crying, smiling and fearfulness will be discussed as examples of affect structures which develop at different levels of organization. A second model represents discreet emotional expressions and their organization in a 3-dimensional space and results from multidimensional scaling techniques of data analysis. An epigenetic shceme will be presented for the development of discreet emotions which includes biological, social and cognitive factors. Finally, the early development of affect will be discussed from the point of view of psychoanalytic ego psychology wherein it will be proposed that affects are central motivating forces, serving as signals which give information to regulate our internal environment. In early infancy, certain patterns are inborn and affective signaling is social. Caretakers, in the average expectable environment, are predisposed to act predictably in response to these signals in such a way as to regulate the infant's internal state. Later, especially beginning at 7-9 months, patterns of affect response emerge which are internally motivating.

Affective Aspects of the Attachment of Infant to Mother: Individual Differences and their Correlates in Maternal Behavior. MARY D. SALTER AINSWORTH (University of Virginia)

Three main groups of infants are distinguished in terms of their behavior toward their mothers in the latter part of the first year of life. The infants of one group are characterized by secure affect; the infants of the other two groups are anxious. The anxious infants experience conflict in their interactions with their mothers, but the kinds of conflict differ in the two groups.

The three groups will be compared in terms of: (a) their behavior in a mildly stressful laboratory situation at the end of the first year; (b) their behavior at home throughout the first year of life; and (c) the behavior of their mothers in interaction with them throughout the first year. Particular attention will be given to the following aspects of infant behavior: use of the mother as a secure base from which to explore, amount of crying, separation anxiety and conditions under which it is manifested, behavior and affect upon reunion after separation, behavior and affect relevant to physical contact, avoidance, and anger. The relations between infant and maternal behavior will be considered, and hypotheses will be presented about the developmental dynamics of the three attachment patterns.

Perception, Cognition and Emotion in Human Infancy. JOSEPH J. CAMPOS (University of Denver)

Recent theorizing on the nature of human emotions has centered on the role of cognition as mediating the elicitation of different emotions. In human infancy, the operational definition of cognition has largely depended on interpretations of Piagetian theory. However, the empirical literature has largely failed to support any clear relationship between developments in sensorimotor intelligence and affective development. In the proposed presentation, we will review some of the major studies on the relationship between cognition and emotion, demonstrate how misunderstanding about infant cognition may underlie the failure of previous work, and cite important recent developments with clear implication for understanding the ontogeny of emotions. We will present evidence, in particular, on how Piagetian theory can account for developmental shifts toward fear of heights, and will link the onset of representation in the infant to the smiling response. We will also cite evidence for the importance of biological factors such as temperament, and for experiential factors in accounting for the development of fearfulness.

Organization of Emotional Development. L. ALAN SROUFE (Institute of Child Development, University of Minnesota).

Emotions and emotional development may be viewed from an organizational perspective. Rather than seeking the (first) age at which an emotion occurs, emotions are viewed as evolving systems, with an increasingly active role for the infant and an increasing role for meaning (psychological factors) vs. physiological factors. Regardless of the semantics, this developmental process is seen in the wariness-fear, rage-anger, and pleasure-joy systems, with qualitative differences in developmentally later reactions. For example, very young infants sometimes become distressed in the face of arresting stimulation, but it is only later that the particular content of the event is crucial. An organizational perspective also has implications for the study of affect and cognition, the relationships between behavioral systems, and the integrating role of affective constructs in development. Not only are affect and cognition associated, but they are seen to be mutually influential as well and to be tied together in salient issues within social development. Moreover, when early competence is defined as the coordination of affect, cognition, and behavior, studying infant emotion becomes crucial for uncovering the roots of maladaptation. Crucial developmental issues may be defined, each with an affective core. Competence with respect to each issue influences later development. For example, when attachment is defined as an affective bond, stable individual differences with consequences for later adaptation have been shown.

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The Life Cycle: Development in the Middle Years

Arranged by DANIEL J. LEVINSON (Yale University)

Tues., 14 Feb. / Shoreham / Forum

3:00 p.m.-6:00 p.m.

Personal Transformations in the Post-Parental Period: A Cross-Cultural View. DAVID GUTMANN, Ph.D. (Northwestern University Medical School).

The human life cycle, viewed as a sequence of psychological stages, is to some degree fixed and predictable in its organization; as such, the human life cycle can be viewed as an outcome of species evolution, while the periods of middle-age and aging can be regarded as the *post-parental* phases of the life cycle. Cross-cultural studies highlight recurrent features of male and female psychological orientation in the post-parental period. Citing transcultural data, this paper proposes that psychological development in the post-parental period is stimulated by the release of motivational and cognitive potentials that were blunted in the service of parenthood. Thus, men regain some of the emotional capacities that are sacrificed to their parental role, of supplying physical security; while women regain some of the competitive potentials that were repressed in order to supply emotional security. And both sexes regain the egocentricity that was hitherto lived out through children. Such emerging potentials can become the pivot of pathology or of renewed development, depending on the individual's temperament, and psychosocial circumstances. Transcultural data will illustrate the ways in which social institutions can function so as to bring about the transformation of developmental potentials into new executive capacities of the post-parental personality.

Personality Development of Men and Women in the Middle Years. FLORINE B. LIVSON (Institute of Human Development, University of California, Berkeley).

This paper looks at personality development in the middle years in a group of well-functioning women and men at 50 who were studied longitudinally since adolescence. Personality change in the middle decade (ages 40 to 50) is analyzed from an "ecological" point of view: from the perspective of the "fit" between an individual's personality over time and changes in her or his social roles and life situation. Congruence between personality and social roles tends to reinforce the individual's preferred personal style, leading to personality stability over time. Incongruence between personality and social roles may require the person to modify the self if he or she chooses to conform to traditional role expectations. The individual may suppress sides of the self which are incongruent and emphasize others which are adaptive. Special attention is given to the fit between gender roles and personality. Traditional women and men in this study -- those whose personalities fit traditional gender roles in early adulthood -- move smoothly into middle age with little change in personal style. Non-traditional women and men who conform to traditional roles in early adulthood suppress cross-sex characteristics, often at the cost of emotional stress. But these individuals revive cross-sex characteristics by age 50 with an upsurge in psychological health. Changes in life tasks in the middle years allow some individuals fresh options to expand the boundaries of the self.

The Mid-Life Transition: A Developmental Link Between Early and Middle Adulthood. DANIEL J. LEVINSON (Department of Psychiatry, Yale University).

I conceive of the life cycle as a sequence of partially overlapping eras, each lasting about 25 years. The era of early adulthood extends from roughly age 17 to 45, that of middle adulthood from 40 to 65. The Mid-Life Transition, from about 40 to 45, forms a boundary region between them, serving both to terminate early adulthood and to initiate middle adulthood. It is a period in normal psychosocial development. I regard adult development as the evolution of the individual life structure. The life structure is the overall design of a person's life at a given time. It includes one's various roles, group memberships and relationships, as well as the wishes, values and parts of the self that are reflected in it. My findings deal mainly with men. The male adult life structure evolves through an invariant sequence--an alternation of structure-building periods and structure-changing or transitional periods. A structure-building period ordinarily lasts 6-8 years; its primary task is to create a new structure and enhance one's life within it. A transitional period lasts 4-5 years; its task is to reappraise and modify the existing structure so that a new one can then be built. In the Mid-Life Transition, a man must come to terms with his youthful dreams and terminate early adulthood. He must deal with old illusions about work, marriage, self and others. He tries to integrate basic polarities: Young/Old, Masculine/Feminine, Destruction/Creation, Attachment/Separateness.

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The Extended Household in a Post-Industrial Society

Arranged by DAVID P. SNYDER (U.S. Internal Revenue Service, Washington, DC)

Thurs., 16 Feb. / Shoreham / Forum

9:00 a.m.-12:00 m.

Defining the Family for the 21st Century. CAROL STACK (Duke University)

Today, scholars recognize two basic family structures: the nuclear family, and the extended kinship network. While the nuclear family has emerged as a highly-regarded adaptation to industrial capitalism, the durability, stability and effectiveness of the extended family as a support system among poor blacks and urban ethnics has only recently received recognition. Very few public policies reward those relatives outside of the immediate "household" who provide daily nurturing and economic support, and most national policies (e.g. welfare, public housing, etc.), tend to undermine these support systems. While family policy experts have now come full circle in their endorsement of public policy support for "alternative family structures", few of these experts recognize (or acknowledge), the extent to which current national policies undermine the stability of mainstream nuclear families, especially the growing number with two working parents. In surveying the continuum of family and family-like structures, this paper suggests that policies which impact upon families can, and should, be designed to be neutral with respect to both traditional and innovative family structures.

The Market and the Budget: Should Society Be an Extended Household? KENNETH BOULDING (University of Colorado).

There are two contrasting methods by which resources may be allocated and roles and tasks assigned in society. One is the market, operating through the price-profit mechanism, under which power is widely distributed, producers react to the purchases of consumers, and the system moves towards a moving equilibrium which is determined by a combination of conditions of demand and supply. The other method of allocation is the budget or plan, by which funds are granted to a particular subdivision, department, or individual in response to a demand on the part of a grantor for certain services. The household operates essentially on a budget basis, though there are, as in all budget organizations, important considerations of reciprocity, and especially of the terms of reciprocity among the various parties, which in a sense simulate a market within the household and in some degree within all organizations. The fact that many values of high priority, such as love, trust, affection, and so on, are supposedly generated within the household has led to pressure for extended households, of which the drive towards socialism and communism is motivated in part by a desire to extend the concept of the household to the whole society. This may, however, produce serious pathologies simply because of the diseconomies of scale and the appropriateness of different organizations. A key to the solution of this problem may be an improvement of the "grants economy" and the development of market simulations in budget processes through competition for budget allocations.

The Household School as Life-Span Learning Center. WINIFRED I. WARNAT (American University).

Presented is the perspective of the family as a learning institution. The concept of the household school and how it functions is introduced. The life-span learning process is defined and viewed within the framework of alternative family styles, with "family" (primary group) members functioning in the roles of teachers and students. The design of the household school is related to the operating family style, which, in turn, determines the curricular orientation taken. In this experientially-based curriculum, concentration is on the affective dimensions of learning within the family milieu. Also included are areas such as child care, life planning, and neighborhood participation . The basic hypothesis to be addressed is that, the more limited and negative the experiential base, i.e., the psycho-social and economic determinants of the family environment, the more rigid and limited the learning opportunity and effectiveness of the household school. In conclusion, a model for the household school as an education center incorporating the life-span learning process is given.

Families and Familiar Groups as Molecules of Society. GREGG EDWARDS (National Science Foundation)

The apparent dissolution of the traditional family, as noted in recent years, may be largely perceptual - modern communications make the range of human diversity more noticeable. A long-standing variety in familiar (family & primary group) structures has been noted by recent historical and cross-cultural surveys; further, such studies have indicated a close relationship between economic and political conditions and variations in familiar structure. Today, changes in key familiar elements (e.g. gender roles, family size & make-up, divorce, etc.), plus changes in political and economic conditions, have given prominence to a number of widely divergent models of familiar structure, and prompted a growing controversy over which models should be promoted in our public policy. This paper first reviews some of the major variations in familiar structures, and discusses principal ideological and legal models of familiar groups and relationships. Second, familiar groups are discussed in terms of their abilities to meet the diverse, multiple and evolving needs of their members. Finally, the familiar group is set in the context of a society-wide institutional hierarchy, in which its role as a molecular unit of larger institutional forms (e.g. neighborhoods, etc.) is developed, and related to the functional interests of society to form a human ecology of social organisms. In summary, familiar groups are presented as bodies of interpersonal arrangements whose structures may vary widely throughout society or over time, in consonance with political and economic conditions, and the evolving needs and abilities of their several members.

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Families in the Metropolis: Emerging Concerns in Urban Housing

Arranged by HARVEY M. CHOLDIN (Univ. of Illinois, Urbana)

Thurs., 16 Feb. / Shoreham / Tudor

3:00 p.m.-6:00 p.m.

Can Behavioral Science Research Improve Housing Quality? HOWELL, SANDRA (Massachusetts Institute of Technology).

Interactions between families and their residential environments are not yet well understood. The major efforts at studying social and behavioral needs in housing contexts have focused on low-income families in high rise urban settings. Few studies have been based on hypotheses about family interactions in built space over time.

This paper will review the current state of knowledge and propose what appear to be the most fruitful directions for future research. Emphasis will be placed on the constraints found in the transfer of research information to the production of quality urban housing. Approaches based upon social science utilization research will be suggested that may increase the probability of successful transfer.

Moderate Income Families as Consumers of Publicly Assisted Housing. WEIDEMANN, S., FRANCESCATO, G., ANDERSON, J.R. (all of University of Illinois, Urbana)

The escalating cost of housing, particularly home ownership, is an important urban problem. One of the serious implications of this trend is that "open market" housing is becoming unaffordable by moderate income households. The experience of other countries (particularly Canada) suggests that this will result in a shift from single-family to multi-family accomodations and an expanded role for programs of public assistance.

This paper summarizes major findings of a study to identify and measure design, management, and resident characteristics contributing to user satisfaction with the multi-family housing environment. A variety of data collection methods were employed to obtain information about 37 low and moderate income housing developments. Results demonstrate the high degree of interdependence between social, design, and managerial features. Implications for research as well as for the development of improved indicators of housing quality are considered.

Environmental Preference, Habitat Selection, and Urban Housing. RAPOPORT, AMOS (University of Wisconsin, Milwaukee).

In addressing the question of "normal family life in the city," I will begin by raising questions regarding the meaning of these terms, which vary depending upon context. Using comparative examples, including some recent teaching and research experiences in Israel, totalling 8 months, I will then present a general way of looking at this problem, discussing various factors which might play a role in the acceptability and success of particular forms of housing and settings -- including urban housing. A discussion of these factors reveals the variability of responses and the effects of socio-cultural variables. After suggesting that group specificity is a most important factor in discussing this (as well as other design and environment-behavior problems) some suggestions are made about how one might go about this. The argument is made that knowing the group in question, its behavior (including latent aspects) and its preferences and what these mean, it may become possible to develop design alternatives which communicate similar and desired meanings and images, and make desired behaviors and activity patterns possible. Under those conditions apparently different housing forms may be perceived as being equivalent, and urban housing fully acceptable, even in the U.S.

Housing and the Quality of Family Life. KLOBUS-EDWARDS, PATRICIA (Virginia Polytechnic Institute and State University), EDWARDS, JOHN N. (Virginia Polytechnic Institute and State University), BOOTH, ALAN (University of Nebraska, Lincoln).

The effect of housing type (single family, duplex-townhouse, low rise and high rise) on numerous indices of the quality of family life were examined. Reproduction, child physical and intellectual development, and quality of parent-child relations are among the factors studied. A sample of 560 urban families that were interviewed and medically examined provide data for the study.

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The Aged in Families

Arranged by NORMAN METZGER (Natl. Research Council, NAS)

Fri., 17 Feb. / Shoreham / Tudor
9:00 a.m.-12:00 m.

Perspectives on Caring for the Aged. ROBERT N. BUTLER (National Institute on Aging, NIH, Bethesda, Md.)

Families are major caretakers for the aged. The implications in terms of research needs, policy, historical evolution, and future issues will be discussed.

Historical Role of the Aged in American Families. DAVID F. MUSTO, M.D. (Yale University)

The demographic changes in the American population over the age of 65 will be sketched. Trends in attitudes toward the aged will be reviewed and conflicting historians' interpretations of literary evidence will be considered.

Problems with Aged Parents. JANE OTTEN (Washington, D.C.)

Presentation will focus on problems adult children face when they care for aging parents, including attitudes and emotions on both sides, family relationships, managing mechanics and logistics for a parent who needs some or a great deal of help, and finding sources of help in the community.

The Federal Role. ROBERT M. BALL (Institute of Medicine, Washington, D.C.)

The major support which the federal government has given to families caring for elderly relatives is through the provision of a social security benefit to the elderly person. (Ninety-three percent of those 65 and over receive a social security benefit every month and 95 percent of those becoming 65 in 1977 will be eligible for such a benefit.) In addition, the federal government operates a national health insurance system for the elderly and the disabled (Medicare) which pays most of the cost of hospitalization while contributing to a lesser extent toward meeting the cost of physicians and other health services. The federal-state program of Medicaid, based on a need test, supplements the Medicare insurance program and pays the major part of long-term nursing home care for the elderly. The contribution of these programs in enhancing the ability of the family to care for older relatives has been enormous. Yet, there remains a significant gap: there is no coherent federal policy directed to the provision of long-term care which would help the individual remain at home to the extent he wished to and could, and no provision of a variety of institutional care services of different levels of intensity for those who needed or preferred group living arrangements. This paper will discuss what the federal government has done, what the gaps are, and what in the opinion of the author it should do.

12. ANTHROPOLOGY

The Viability of the Village in Contemporary Society

Arranged by PRISCILLA REINING and BARBARA LENKERD (AAAS)

Mon., 13 Feb. / Shoreham / Empire
9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Villages in Regional Perspective: The Middle East DANIEL G. BATES (Hunter College).

Regional analysis in the study of settlement and land use is of growing importance in Anthropology. A recent two-volume work edited by Smith is indicative of the interest in regional studies, and their potential contribution. Apart from Archaeological analysis, few attempts have been made by ethnologists to understand contemporary systems of regional settlement and land use. This paper will review a number of regional studies conducted in the Middle East. Then data from Northeastern Iran regarding variability in settlement size, family structure and land use are analyzed.

Time Perspectives in Village India. CHARLOTTE WISER.

The viability of villages of North India is maintained in a number of ways. Most immediately apparent is a distrust of strangers. Outsiders are kept at a safe distance from the life of the village. Security is far more important to a villager than competition. Security assures a livelihood for families existing precariously from harvest to harvest. The long established Jajmani system guarantees each family a place in the village economy and guarantees the village the services of the family. For security, farmers live inside the village, not on their land. Side walls adjoin those of neighbors, and outside walls are solid. Doors and windows open into the courtyards where the women live and work. Every village man and woman has a share in supporting the village, by eating food from their own fields or those of neighbors. Whatever must be purchased, like salt or mustard oil for cooking, is purchased from a local shop. Nothing is wasted or spent on comfort. Every inch of space in the family enclosure is used. The courtyard provides space for work and the rooms serve for storage. New outside forces threaten the viability of the village. By government ruling, an enlarged village council has replaced the traditional panchayat of elders accepted for their seniority and service to the village. Seats on the new council are won by show of hands, and the head of the council is elected by secret ballot. An element of competition has thus been introduced. However, if the traditions found useful for security are maintained, the viability of the village will be preserved.

The Future of Rice Monocultures in Southeast Asia. CLIVE BELL (Economist, Development Research Center, IBRD).

Human Development in Traditional and Modernizing Villages. MICHAEL MACCOBY (Harvard Project on Technology Work and Character)

As a "part society", the modern village must be understood in relation to the city. This is true not only of peasant villages in a "developing" country like Mexico, but also of small towns and villages in a "developed" country like the United States. Traditional values and social character are under pressure from the new industrial culture. In some ways, this is impossible to control. Other pressures, however, result directly from policies of industrialization, land tenure, loan programs, and education. Is it possible to conceive of social and economic policy according to criteria of human development?

The Role of the Village in Sahelian Development. DAVID SHEAR (Agency for International Development).

The great drought of 1969 to 1974 focused world attention on the long neglected countries of the Sahel. As a result of massive international relief efforts and the coordinated initiatives of the Sahel states a disaster of massive proportions was narrowly averted. Building on the experience derived from the emergency effort, a comprehensive long-term development program has now been established. The principal objectives of this program are to make the Sahel less susceptible to drought, ultimately self-sufficient in food production and by the end of the century, economically self-sustaining. Because of the lack of basic institutional, human and physical infrastructure, the focus of the program is on the villages of the Sahel. These villages have remained historically strong because of the decision by the colonial powers to govern through local institutions. The villages and sub-clan groups have, therefore, been at the center of economic change over the past century.
We can expect the village structure to undergo considerable stress because of the increase in tempo of economic development in the area. In order to retain the basic strength of the village system, we are seeking the means of channeling external aid to the maximum extent possible through traditional lines. Also important is the return flow of information from villages to the Government on local reaction to economic development efforts. Essential to village structure and a key link in future growth will be limitation of population increase, better land use and establishment of adequate local social services.

Transformation of Hungarian Villages. CONRAD C. REINING (Catholic University).

Traditionally Hungarian villages were largely closed systems which provided most of their own goods and services while producing a surplus with which to buy a limited range of manufactured goods. Hungary was relatively late in abolishing serfdom and in industrializing, so that the rural social structure remained relatively unchanged until WW II. Drastic changes in land use control after WW II, increasing industrialization, along with mechanization of agriculture, have meant profound changes in the relation of villagers to the land and in attitudes toward village life. These changes differ as to generation and it is difficult to predict what future trends will be. Older subsistance patterns persist along with the present program to increase industrialization without commensurate urbanization. The situation can be viewed as a clinical experiment of a scope and intensity that no social scientist would have dared propose, but is an excellent opportunity for studying social and cultural change, nonetheless.

New Village Uses of Renewable Energy Sources. JAMES W. HOWE (Overseas Development Council)

Half the world's people still live outside of industrialized urban areas and have little or no access to modern energy services. They currently rely on their own muscles supplemented only by draft animals and firewood--which in many areas is being rapidly depleted with serious environmental consequences. The cost and pace of extending conventional energy distribution networks are such that most of these people will never live to receive their benefits. There are a variety of technologies that can convert the rays of the sun, the organic wastes of humans, herds, and fields, the winds, and flowing water into usable energy that can be used to pump or distill water, and otherwise supplement and supplant the use of human muscles and reduce overconsumption of firewood resources. These technologies are proven in laboratories, space ships, and in the villages of China, and a few other countries. But the main problem is to introduce them into the villages of the Third World in such a way that villagers incorporate them into the village economy and make use of them, rather than regarding them as experiments of alien technologists to be abandoned as soon as the last technician leaves. The speaker will comment from his work and that of others on the villages of Africa.

Education for Self-Reliance and Participation. JOHN SIMMONS (Economist, Policy Planning Div., IBRD. Washington, D.C.).

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Fertility Decline in the Less-Developed Countries: The Emerging Pattern

Arranged by NICK EBERSTADT (Rockefeller Foundation, New York, NY)

Tues., 14 Feb. / Shoreham / Empire

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Fertility Decline In Less Developed Nations, 1945-75: A Quantitative Analysis
W.PARKER MAULDIN(Population Council)

This paper represents an attempt to compile meaningful figures for fertility change for less developed countries in the postwar period. Fertility change will be analyzed in terms of changes in marital structure and intermarital fertility, and an attempt will be made to discern whether alternative patterns of fertility decline have emerged in different ethnic and geographic regions of the less developed world.

LDC Fertility Declines In Historical Perspective MARIS VINOVSKIS(University of Michigan)

In what ways are the demographic and socio-economic patterns of nations now undergoing the transition to low rates of fertility different from those experienced by the now 'developed' nations? This paper shall examine historical continuities and dissimilarities in the process of 'demographic transition' with a special discussion of the relevance of various 'models' of decline.

Middle Class and Poor in the Empirical Study of Development. NATHAN KEYFITZ (Harvard University).

Development can be described as a process in which individuals and families move from poor and rural to middle class and urban, with or without an intermediate phase of poor and urban. On this view the change of culture is basic, higher income being a means to this change. Thus what seems to appear to occur in developing countries is different from the asserted objective of relieving the poverty of the poorest, or at least of raising incomes all around. It is rather a shift for a certain fraction of the population to a way of life that includes supermarkets, automobiles, annual vacations. Such a change is a sufficient condition for reducing family size, but current evidence suggests that it is not a necessary condition. Apparently contraception is being effectively employed not only by those who have scaled the barrier surrounding the middle class, but also by many for whom this is still an aspiration.

Observations on Changing Dynamics Between the Impact of Health Programs and Fertility. SUSAN C.M. SCRIMSHAW, PH.D. (School of Public Health, University of California, Los Angeles, California 90024).

Nutrition and health programs are basically intended to reduce morbidity and mortality, while family planning programs are intended to reduce fertility. However, there is much current debate on the interdependence of mortality and fertility declines. A major question is whether particularly infant mortality declines must be perceived and believed by individuals before they will undertake the regulation of their fertility. This paper discusses this question, and the related question of behavior related to morbidity and mortality in infants in relation to fertility decline. Such behaviors may affect ultimate family size as much as fertility regulation. Thus, the actual use of nutrition, health and family planning programs is part of a complex set of behaviors reflecting the interrelationships between mortality and fertility decline.

Ecological Problems Involved In the Transition To Low Fertility Rates. RICHARD TABORS (Energy Research Laboratory, M.I.T).

Environmental degradation is a problem often associated with advanced industrialized societies; less developed countries, however, are plagued by ecological problems which, if considerably different, are certainly no less severe. This paper asks two basic questions: i)In what ways does the transition from high to low rates of fertility alter the locus of ecological problems facing the LDC? ii)Are they changes which are likely to be dealt with effectively? The backdrop for this paper is Nepal, a nation whose ecological plight is rapidly becoming a source of public as well as academic concern.

Fertility Decline In The People's Republic Of China JOHN AIRD (Department of Commerce)

This paper will try to make sense of the scanty and often contradictory reports emerging from the PRC on its population size, its rate of natural increase, the changes in its rates of fertility, and the efficacy of its family planning programs.

Government Policy And Fertility Change: Effect And Efficacy William Peterson (Ohio State University)

This paper will examine the advertent and inadvertent effects of governmental attempts to directly influence fertility in poor nations.The author argues that such attempts are nonproductive,or even counterproductive, unless coupled with more far reaching social and economic policies.

Population, Food Intake and Fertility: Historical Evidence for the Direct Effect of Nutrition on Fecundity. R.E. FRISCH (Harvard Univ.)

Historical data on nutrition, physical growth and reproduction in mid-19th century Britain suggest that undernutrition and hard work may be an explanation of the observed sub-maximum fertility of working class couples of those times. The diet of the working class was inadequate in quantity and quality, particularly for the women and children. Growth in height and weight was slow and differed by social class: Men did not attain final height until 23-25 years; women not until 20-21 years. Reproductive data show a biologically consistent pattern of a late age of menarche, an early age of menopause, long birth intervals, and long periods of adolescent subfecundiy and premenopausal subfecundity. The data suggest that slow, submaximum growth to maturity is subsequently associated with a shortened and less efficient reproductive span. Subfecundity may contribute to the relatively low number of living births per couple, about six (6), in developing countries. If so, nutrition and family planning programs should be integrated for the well-being of the mother, child and the society. The need for family planning programs also may be much greater than realized heretofore.

The Economics Of Child Rearing In Less Developed Countries MONI NAG (Population Council)

To what extent has the fertility decline experienced in less developed countries in the past quarter century been due to shifts in the material rewards parents can expect to reap from their children, and the costs they can expect to bear? This paper shall attempt to quantify the benefits and costs involved in raising children in several societies, and shall bring together the evidence on how these benefits and costs are likely to have changed, and are likely to change in the future.

Income Distribution, Development, and Fertility Decline in the Less Developed Countries ROBERT C. REPETTO (Harvard School of Public Health).

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Keystones of Culture: The Discovery of Culturally Specific Behavior Patterns Through Research Film Analysis

Arranged by E. RICHARD SORENSON (Smithsonian Institution)

Wed., 15 Feb. / Shoreham / Empire
3:00 p.m.-6:00 p.m.

The Challenge of Phenomenological Inquiry in the Human Sciences. E. RICHARD SORENSON

A Design for Visual Data Collection and Analysis: Research Filmmakers Working with Anthropologists. WILLIAM H. CROCKER (Smithsonian Institution).

Research filming is most easily accomplished in collaboration with an experienced ethnographer in residence so that he can introduce the research filmmakers and resolve problems should they occur. In the Canela research film study, a research filmmaking team filmed among the Canela for three months shooting almost 85,000 feet in that time. Filming focused on several specific topics is necessary, but footage randomly sampled was included to fill in gaps. The full film record can be analyzed to reveal behavioral patterns. While most ethnological materials are best obtained according to traditional methods, certain crucial behaviors involved in group dynamics, socialization, ritual behavior, proxemics, social life, etc.--especially fleeting gestures and covert motions--are best first identified and quantified during research film analysis and later tested during follow up fieldwork, with the tribe's ethnologist having the major interpretive responsibility. The addition of such complementary and dynamic materials to old and new ethnological studies provides new data on human organization which can then be brought to the profession through edited research report films and ethnological monographs which deal in greater detail with culturally specific bahavior patterns. Massive support for such studies is warrented to record the now vanishing tribal sociocultural systems for posterity.

Rivalry Patterns in Everyday Pashtoun Society. ASEN BALIKCI (University of Montreal).

Institutionalized patterns of rivalry among Pashtoun chiefs has been described by Barth and others. Recent fieldwork in Northeastern Afghanistan among semi-sedentary Pashtoun revealed the existence of a broader network of rivalry relationships involving same-sexed individuals in similar structural positions throughout the society. Film studies helped to discover the full range of these patterned dyadic relationships in which processes of substitution are occasionally applied by rivals and the audience necessary for acting out of rivalry behavior. Occasionally rivalry should be expressed publicly in a quasi-theatrical atmosphere and sanctioned by the community. This public expression of aggressive rivalry has a cathartic effect and the Pashtoun society has in this way succeeded in ritualizing and harnessing aggressive behavior.

Patterns of Canela Indian Children's Play. STEVEN C. SCHECTER (Smithsonian Institution).

In the summer of 1975 a research film study was carried out among the Canela Indians of Maranhao, Brazil who have been in contact with Westerners since the arrival of the Portuguese and yet have maintained much of their traditional life style. Through repeated examination of the almost forty hours of research film we discovered the pattern of Canela children's play last year in which the extensive personal freedom to express individual penchant goes hand-in-hand with strong group solidarity. Intimacy of shared empathy seems to play a role in this nonWestern type of human organization. In the area of exploration, children are not restricted from playing with machetes or fire, and adults usually tolerate whatever line of inquiry their curiosity impells them toward. Empathy manifests itself most clearly in the synchronous and consensual games children improvise with each other, and extends to a sensibility which children develop for each other's needs and desires. Exploration allows the child to learn the skills needed to exploit his environment at an early age, and thus instills self-reliance. Exploration and cooperation develop in a setting of interdependence which facilitates a style of life embodying the mutual reinforcement of individuality and solidarity at an early age. Empathy and exploration both in others and in oneself appears to be a major factor in Canela life which has allowed them to endure as a unified society.

A Style of Intersibling Affect in Micronesia: A Prerequisite for the Sociopolitical Organization. E. RICHARD SORENSON (Smithsonian Institution).

In the Western Caroline Islands of Micronesia, social structure which appears hierarchical when viewed in terms of Western cognitive structure becomes consensual and nonauthoritarian when examined systematically from a digressive phenomenological point of view. The patterning of affect and human response provided to their growing young by these Micronesian people reveals some of the underlying dynamics of a nonWestern system of human organization. Systematic analysis of undifferentiated, uncategorized, phenomenological data of daily life behavior provides the root to this type of inquiry.

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Emergence of Language: Continuities and Discontinuities

Arranged by STEWART H. HULSE (Johns Hopkins University)

Thurs. 16 Feb. / Shoreham / Empire

9:00 a.m.-12:00 m.

Emergence of Language: Continuities and Discontinuities NOAM CHOMSKY (Massachusetts Institute of Technology)

To determine the nature of human language (analogously, the human visual system, etc.) is a task of the natural sciences. The answer will be a specification of the genetically-determined "language faculty," which we may regard as a function that maps evidence available into mature state attained. In contrast, the question whether some other system (e.g., mathematics, music, the system of ape calls) is a "language" requires preliminary conceptual analysis to clarify what is understood as "language" (analogously, the question whether the operation of some light-sensitive system is to be called "vision"). At issue is the usefulness of certain analogies. A cognitive system such as human language can be studied along several dimensions: structural principles, manner of development, etc. Investigation of these suggests only superficial similiarities to symbolic systems taught to apes, at least in the areas where anything significant is known about human language, a conclusion consistent with traditional views and with reasonable speculation about evolutionary history.

Sign Language versus Spoken Language
WILLIAM C. STOKOE (Gallaudet College)

Placing a system like a modern sign language of the deaf in advance of spoken language greatly enhances the case that language has evolved, and it also multiplies the number of continuities to be found. While some sign languages have been devised by setting gestural signs (gSigns) to represent words, a number of sign languages have well enough studied now to show that derivation can only have proceeded from sign language towards spoken language.

Much of the evidence for the change from signed to spoken language comes from studies of human behavior, as it should; but some comes from comparative studies. Chimpanzees, shown by molecular biology to be man's very close relative, apparently use gSigns for some of their cognitive functions. Further evidence that gSigns served as words before spoken words emerged comes from study of sign languages used by those whose access to spoken language is indirect. Other relevant data include children's utterances, pointing and reaching, the relative distractability of spoken versus gestural language, and grammars of sign language. These and other considerations lead to the conclusion that language is at least partly a capacity that has continuously evolved.

Neural Mechanisms of Communication in Man.

DOREEN KIMURA (University of Western Ontario, London, Canada).

Damage to the left cerebral hemisphere in man can severely affect the ability to communicate, and the common interpretation of this finding has been that some functions both specific to language and peculiar to man are affected, i.e., representational or language functions. This paper suggests instead that the specialized functions of the left hemisphere are not specific to language but are related to control of movement; and that speech is but one of the complex motor functions so controlled.

Evidence will be reviewed which suggests that the left hemisphere contains a system for the selection and precise achievement of postures of the upper limb and articulatory musculature. Defects in this system result in the inability to control hand movements known clinically as apraxia, and in the deficits in speech known as aphasia. These impairments in motor control are at least as apparent in nonverbal movements as in verbal movements. The data suggest that there is no sharp separation between language and non-language systems in the brain, and that the left hemisphere is specialized, not for language function *per se*, but for some types of motor activity which, in the course of evolution, happened to lend themselves readily to communication.

Comparative Psychology of Language Acquisition.

BEATRICE T. GARDNER and R. ALLEN GARDNER (University of Nevada)

Our research on teaching sign language to chimpanzees proceeds from the assumption that any form of behavior, human or animal, if it exists at all, exists as a natural, biological phenomenon. If a form of behavior such as human language appears to be different in character from other forms of human and animal behavior, then we do not abandon the search for general laws; instead, we question the adequacy of existing observations. Before Project Washoe, there were two general courses that might be pursued to obtain more relevant data. A linguistically sophisticated attempt could be made to study animal communication, or a means could be found to teach a human language to an animal. With respect to the first alternative, there has been little progress so far because, we feel, inappropriate methods have been used. With respect to the second alternative, much progress has been made. and this is the general topic we discuss. In addition to a report of new and recent observations from our work with chimpanzees, we compare our data with those derived from studies of human language development. We also comment upon the adequacy of the efforts of others to teach communicative skills and language to chimpanzees. Throughout, we emphasize the importance of rigorous testing under conditions designed to be as naturalistic as possible.

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An Account of the Auditory Mode: Man versus Ape

Arranged by FRANK E. X. DANCE (Univ. of Denver)

Thurs., 16 Feb. / Shoreham / Empire

3:00 p.m.-6:00 p.m.

The Advantages of Ephemerality in the Acquisition and Conduct of Speech Communication.

RALPH B. THOMPSON (Denver Colorado).

Referentiality (semanticity) is one feature which distinguishes human communication (speech communication and its derivatives) from other animal communication. In a society suffused with print technology, the spoken mode of human communication, which leaves no permanent record of itself, is often accounted of less worth or importance than the written or printed word. This bias ignores certain advantages which accrue to speech communication by virtue of its ephemerality. In general, the ephemeral nature of speech communication forces the focus of attention upon the event of message production, rather than upon the artifact of the message itself. Within the individual, this feature abets the acquisition of the concept of a referential code. Between individuals it fosters the peculiarly human aspects of interindividual relationships. Within cultures, historically, it has afforded a mnemonic means of record-keeping which is compatible both with the referentiality of linguistically mediated thought and with the requirements for mobility which accrue to a culture not yet advanced enough to insure its food supply without nomadic excursions.

Do Apes Talk? New Data Suggests They Might.

PHILIP LIEBERMAN (Brown University)

The words of human languages consist of discrete "phonemic" segments. Human speech transmits phoneme sequences at a rate of 20-30 segments/sec. Other auditory signals are limited to a 7-9 segment/sec rate. Human speech achieves this fast rate by means of neural mechanisms that resolve subtle acoustic cues. These neural mechanisms appear to be structured by both auditory processes and certain constraints of the physiology of human speech. These mechanisms for speech perception establish sharp linguistic categories that are not always obvious. Acoustic parameters like voice onset time and formant frequency transitions can look like "graded" signals expressing emotion rather than discrete, linguistic signals. Apes can produce many acoustic cues that have a role in human language. Psychoacoustic data also show that primates and other animals categorically discriminate and identify some of these acoustic cues. The question of "natural" non-human speech should be reopened. A conservative hypothesis that can be tested is whether non-human primates make use of discrete acoustic features for linguistic communication. Their speech would have neither the high data rate or the complexity of human speech but the difference would be quantitative rather than qualitative.

The Affinity of Sound and Thought.

WALTER J. ONG (Saint Louis University).

The sound field differs from other sensory fields (1) in its relationship to time (unlike visual or tactile objects, sound is evanescent, exists only when going out of existence, and reveals not objectivity as such but the present use of power) and (2) in its relationship to interiority (sound can reveal interiors without breaking into and thus diminishing interiority, as in ringing a coin, thumping a melon). In all cultures the spoken, sounded word appears as the most immediate correlative of matured, formulated thought (juncture of subject and predicate). Writing is a uniquely valuable but always secondary development, deriving from the unconscious less than does speech. There is reason to believe that human thought is necessarily dependent on access to sound, that other sensory fields alone cannot provide adequate support of the sort thought requires. (The congenitally deaf, who use nonauditory coding in reading, cannot be brought to read at normal speeds even silently.) All this suggests that if apes are to be taught to use language representing thought, their achievement will have to be grounded somehow in sound--as well as in the apes' unconscious, if apes have an unconscious.

The Centrality of the Spoken Word.

FRANK E. X. DANCE (The University of Denver)

Is the fact that human language is spoken a trivial or non-trivial fact? The consideration of the role of the spoken word in the effort to teach chimpanzees a form of human language suggests a position of modal equipotentiality. This paper makes an argument for the modal dominance, at least developmentally, of the spoken modality in human communication. The human's acquisition of some sense of objectivity, leading to decentering, displacement, and symbolization may flow from the infant's use of the spoken mode.

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Public Anthropology

Arranged by BELA C. MADAY (American Univ.) and LAURA NADER (Univ. of California, Berkeley)

Fri., 17 Feb. / Shoreham / Empire

9:00 a.m.-12:00 m.

Anthropology & Development, D. Glynn Cochrane, Syracuse University

Since the early 1970's attention in the development assistance community has focused on the poorest people in the Third World. The contemporary development assistance policy of both multilateral and bilateral agencies seeks to mount projects dealing with population control, nutrition, education, and provision of jobs, where the poorest would be the ultimate beneficiaries. This raises important issues about how poverty is to be measured and defined and how progress on the alleviation of poverty is to be assessed.

The good news is that anthropology has a vital role to play in this process because the discipline has unrivalled sources of information built up over half a century, a unique capacity to deal with the behavioral dimensions of projects, and has, in many instances, the confidence of poor people. In moral and ethical terms the current policies are those which most anthropologists can support in contrast to the reservations anthropologists had about policies which emphasized per capita growth and increasing GNP.

The bad news is that there are constraints on anthropological participation. Classical anthropology, contemporary practice at many of the most prestigious teaching institutions, and an inability among many anthropologists to distinguish between science and politics imperill the development of broad scale participation by anthropologists. However, these objects can be resolved in a way that would preserve the academic and the practical traditions in anthropology.

Social Impact Assessment and Anthropology. JOHN H. PETERSON, JR (Mississippi State University), SUE ELLEN JACOBS (University of Washington).

Social Impact assessment is a newly emerging interdisciplinary field that seeks to predict the consequences resulting from the implemention of policies and developmental programs on human populations. The key to social impact assessment is its emphasis on anticipating the future under alternatives available in planning projects, and their costs and benefits in terms of the social well-being of the population effected. Anthroplogical efforts in social impact assessment is based on a long research tradition on the impact of policies and programs on third world populations and growing research on modern complex societies. But the forecasting aspect of social impact assessment makes special demands on anthropological methodology.

Anthropology and the Federal Government LUCY M. COHEN (National Institute of Mental Health)

Selected programs and activities of anthropologists are discussed in light of changing public policies. The author focuses on processes in decision making, priority setting, and policy developments which have led to new conceptions about the participation of anthropologists in government. Implications for research training are considered.

Archeology, Anthropology, and the Public. CHARLES R. McGimsey III (Arkansas Archeological Survey).

Recent public interest, public law, and the investment of public funds in archeology have served to make archeologists, traditionally academically oriented, increasingly responsive to the need to formulate their research in an anthropological framework and to make the results both meaningful a nd available to the general public.

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Indians of the Eastern United States

Arranged by SAM STANLEY (Smithsonian Institution)

Fri., 17 Feb. / Shoreham / Empire

3:00 p.m.-6:00 p.m.

The Integrity and Continuity of Eastern Indian Tribes. Robert K. Thomas (Wayne State University)

When Europeans first explored the eastern coast of the United States they discovered a large number of Native people living in settlements throughout the area. Relationships with these people vacilated between peace and war and eventually the newcomers far outnumbered the old. After the United States became a nation, less and less was heard about the Eastern native people. Attention turned to more westernly tribes and a deliberate policy of forced resettlement seemed to clear most Indians from land east of the Mississippi River. In spite of concerted efforts to remove them a number of groups managed to survive and remain in isolated areas of the East. Caught between a racial and social definition of themselves, they have consistently clung to their Indian identity. Historical, archival and ethnographic data appear to support their claims.

Problems of the Federal Relationship to Eastern Indian Groups. Stephen E. Feraca (Bureau of Indian Affairs)

With more consistency than not, although much influence by periodic and often contradictory changes is Congressional and public sentiment, federal Indian policy and strategy as applied to most tribes have proceeded through the largely standard treaty, land-taking and administered reservation stages. By contrast, the federal relationship (or absence of such) on the Eastern Seaboard continues to be characterized by nortorious inconsistencies that often mirror similar attitudes of the states and their political subdivisions. This paper focuses on the persistent inability of the Congress and agencies of the executive to recognize the very significantly different political, racial and sociological categories found among eastern tribes or groups. Among the long anticipated results of federal inaction, confusion and somnolence are a socio-political and geographical patchwork the encouragement of political entities of recent vintage, the new political assertiveness of groups devoid of a sense of tribalism and the avoidance of certain reservation based entities who have not yet made their presence felt.

The Relationship of Eastern Indians to other Indians Vine Deloria, Jr. (Golden, Colorado)

A survey of the historical foundations for the difference in legal status between eastern and western Indians with an emphasis on the development of a national legal status for contemporary Indian communities. A concluding critique on the perceptions of the two communities with respect to each other and the lack of historical consciousness now pervading the Indian community which inhibits solution of this inter-group conflict.

The Relationship of an Indian Tribe to it's non-Indian Neighbors. John Stevens (Passamaquoddy Tribe) and Susan Stevens (University of California - Berkley.

We will describe the native Passamaquoddy relationships with their non-Indian neighbors as an on-going process. Contact between these two groups predates the Revolutionary War. During that conflict the Passamaquoddy assisted the revolution and contributed heavily to the action which made Maine a part of the United States rather than Canada. As more and more land was alienated from these Indian people, they experienced growing competition with their neighbors. Laws of the state of Maine did not always make it easy for them to subsist in their traditional way. With the successful prosecution of their claims, the Passamaquoddy have encountered a rising hostility from many of Maine's non-Indian citizens. Much of this is based on misinformation and rumour. We will detail some of the steps taken by the tribe to clarify the situation.

A Solution for Two Hundred Years of Injustice to Eastern Indian Tribes. Thomas Tureen. (Native American Rights Fund).

This paper will basically describe the legal claims which various Eastern Indian groups are pressing at this time. It will examine the legal basis in each case. After establishing the legitimacy of the letigation, there will be an examination of the remedies which are presently provided under the law. There will also be a description of the context within which a settlement might take place. The proposals for reaching agreement on a settlement in each case will be discussed and their implications for all parties will be described.

13. METHODOLOGY OF SCIENCE

The Role of Models in Scientific Inquiry

Arranged by ERNAN McMULLIN (Univ. of Notre Dame)

Mon., 13 Feb. / Shoreham / Board

3:00 p.m.-6:00 p.m.

The Role of Models in Scientific Inquiry. ERNAN MCMULLIN (University of Notre Dame).

The word 'model' has taken on rather different meanings in different scientific contexts. To the logician, a "model" is an entity which satisfies or interprets a particular formal system. The "given" here is the formalism; one seeks for the model. To the physicist, a "model" is in one way the reverse of this. It is an imaginative conceptual structure which enables him to construct a theory to explain a particular domain. If the theory proves a fruitful one, the model is said to be warranted. To the meteorologist, a "model" is a convenient way of summarizing a large amount of data in a descriptive way. And so on . . . Two questions that have provoked much discussion are these: 1) Do successful physical models enable us to make any claim about the structure of the physical world? 2) Are there some parallels between the role of model in science and that of metaphor in poetry that would allow us discern a common function of imagination in both? An affirmative answer will be suggested to both of these questions.

Models as Used in Theoretical Physics. CHARLES W. MISNER (University of Maryland, College Park).*

Models are used for simplification, familiarization, and extrapolation. In simplification the qualitatively dominant concepts for understanding some phenomenon are highlighted by creating an analogue of the real situation built economically from these few concepts. For familiarization an analogy is established to models or theories in a more highly developed or more widely known area. The most important extrapolations use several mutually incompatible models to help open the mind's eye to entirely new concepts that it had not been genetically or culturally prepared to see.

*Supported in part by NSF Grant PHY76-20029.

Models in Geology. DAVID B. KITTS (University of Oklahoma).

Geology is an historical science in which statements about the past are derived and tested within a presupposed, and largely unquestioned, framework of contemporary physical theory. Geologists have decided, in effect, that the highly abstract and idealized theories of science are to be invoked in the explanation of the historical events which they maintain are the proper subject matter of geology. As a consequence the gap between theory and event is especially large in geology; larger than it is, for example, in physics. Models are designed by the geologists to bridge this gap. A geological model is a contrived event, merely conceived or actually realized, which is more complex than those which commonly figure in experimental physics and less complex than those which are regarded as geologically significant. Models are not meant to play a role in the discovery of theories nor even in the illumination of already formulated theories. They are not directed at theories at all. They presuppose theories. Geological models do not substitute for historical events in geological discourse but rather suggest ways of coping with historical events in all their immense complexity and richness.

The Role of Models in Economics. EDWARD J. NELL (New School for Social Research)

The notions of model and of modelling have been quite central to much of recent discussion on the methodology of economics. Production models define conditions for the system to continue. Programming models show how to improve performance. Prediction models forecast whether the conditions will in fact be met or the improvement be forthcoming. But the question economists have to face from the beginning is how to relate models to economic behavior. Do we judge agents by models or models by agents? What are we to make of the "rationality" of the "rational economic man" around whom so much of Neo-Classical economics turned? Who decides what is "rational", the economist or the economic agent? Can the notion of "maximising" bridge the gap here? It will be argued that the Neo-Classical view of the role of models in economics is inadequate, dependent as it is on a combination of questionable positivist and empiricist tenets. Instead, a Classical-Marxian view, much closer to rationalism, seems preferable, making economics something like a social geometry of economic behavior.

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Can Mathematics Be Applied to the Social Sciences?

Arranged by HÉCTOR J. SUSSMANN (Rutgers Univ.) and SANJOY K. MITTER (MIT)

Tues., 14 Feb. / Shoreham / Diplomat

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Uses and Limitations of Computer Models in the Social Sciences JOSEPH WEIZENBAUM (Elec. Eng. and Comp. Sci., MIT, Cmbd., MA)

In science generally, the term model is understood to mean model of a theory. For example, the task of experimental physicists is to determine whether or not the real world is a model of the theories developed by theoretical physicists. Computer programs can, in a certain sense, be simultaneously both theories and models. This circumstance has lead to untold confusion, especially with respect to computer models in the social sciences. It is necessary to distinguish between models in that domain which are truly theory based and those that are made to "work" by heroic means. The latter may well be of some heuristic value, but in almost no cases is the distinction made. Consequently, both social scientists and policy makers are encouraged to take "what the computer says" more seriously than they should. Some of such methodological problems will be discussed in this talk.

The Use of Mathematics in Economics PRAVIN VARAIYA (Elec. Engr. & Comp. Sci., Univ. of Calif., Berkeley)

The actual use of mathematics in economics is evaluated in terms of a) its contribution to making economics a "science", and b) its ability to provide "insight". It is argued that whereas mathematics is the appropriate language of physics, its use in economics has prevented discussion of significant economic phenomena, and instead of representing economic laws it has served to obscure them.

Difficulties and Pitfalls in the Use of Mathematics for the Construction of Social Theories. HECTOR J. SUSSMANN (Assoc. Prof. of Math., Rutgers Univ.).

Social Systems and the Structure of Mathematics.

DAVID BERLINSKI (University of Puget Sound) .

The interiors of certain distant stars are the subjects of interesting mathematical theories; something in the nature of social systems seems to resist a plausible mathematical analysis. The juxtaposition of physical and social systems suggests the obvious question: why is mathematics successful in the first instance but not in the second? In fact, there are recorded successes of mathematical analysis in the social sciences -- game theory, micro-economics, linguistics, but even here the achievements of mathematics put one in mind of meteorology rather than astrophysics. The suggestion is made that certain structures (or objects) may not be accessible to mathematical thought, social systems among them. On the other hand, it is observed that mathematics is either a human creation or discovery; there is thus something strange to the thesis that the organism that produces mathematics is yet capable of arranging himself into social and political relationships that are inaccessible to mathematical thought.

Mathematical Modeling Outside the Natural Sciences

ROGER W. BROCKETT (Division of Applied Sciences, Harvard University)

At the present time there are a great many models being proposed to predict the evolution of critical aspects of world resources, food supply, demographic data, etc. These models have been developed under the pressure of time in response to the challenge of determining the viability of our present social and economic order. Of course these models have not been tested and refined to the extent that models in the physical sciences have. Much more importantly, however, we must not take for granted that such a refinement will occur or is even possible. It will be argued in this talk that reliance on the physical science paradigm -- where such refinement is taken for granted -- is fundamentally inappropriate for certain problems where adaptation is possible and that a different epistomological basis is needed. The use of game theory to deal with the problem of observer-experiment interference will be explored. Evidence will be assembled supporting the hypothesis that there exist significant uncertainty principles which provide fundamental limitations on the accuracy of mathematical models in many areas outside natural science.

Towards a Methodology of Critical Theory: Reflections on the Problem of Meaning in Social Inquiry.

THOMAS MC CARTHY (Boston University)

From their inception to the present the modern social sciences have been viewed against the background of the natural sciences. Typically one or another of the latter has been taken as a paradigm of scientific inquiry and a standard against which progress in the former is to be judged. Of course, this view of the matter has not gone unchallanged; arguments for the distinctiveness of the social sciences — whether in respect to the absence of general laws, the limits to quantification, the unattainability of value-freedom, or whatever — are usually based on an appeal to the "meaningfulness"of social phenomena and the consequent necessity of employing interpretive procedures to grasp them. This paper argues against the natural-scientific paradigm for social inquiry. Rather than focusing on one of the specific themes suggested by that paradigm (e.g. laws, confirmation, measurement, etc.), it attempts to delineate the problem of meaning in social research. Using the work of J. Habermas as a guide, I review some of the different strategies that have been devised to deal with it, including the minimalist position of neo-positivism, the use of rationality models, the purely interpretive approaches of phenomenological, linguistic and hermeneutic inspiration, and structural-functionalism. The reflections are ordered with an eye to motivating a step-by-step expansion of the problematic to a point at which the program for a critical theory, as conceived by Habermas, becomes plausible.

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Mathematical Models of Information Systems

Arranged by ANDREW VAZSONYI (Univ. of Rochester)

Wed., 15 Feb. / Shoreham / Board

9:00 a.m.-12:00 m.

The Calculus of Information, ANDREW VAZSONYI (Graduate School of Management, University of Rochester)

Our society is facing a severe resource allocation problem: How much to allocate to information systems. The magnitude of this problem was first recognized by the advent of the computer, but more recently by the increase in the employment of clerical workers. The trend to increase information systems is continuing and the resource allocation problem is becoming even more severe.

Today there is little science in the resolution of this problem and there is a general feeling of dissatisfaction in managerial circles about information systems. Thus there is critical need for mental discipline to master the unstructured world of complexity of information systems. It is the contention of this speaker that the mathematical method and in particular the development of a calculus of information, is the most effective way to grapple with this situation.

The managers of an organization are modeled by the players of a game. The process to be controlled and the uncontrollable environment are represented by states of stochastic processes. Information is defined as a stochastic function of states of the world and serves to update the data base. Decisions are functions of states of the data base, may change states of the world in a probabilistic manner and are of two types: inquiry and control. Economic consequences depend on inquiry and control and optimization must be performed by considering both types of decision.

The presentation includes a general mathematical paradigm and various examples.

Calculation of the Value of Information in Uncertain Decision Problems, PROF. W.T. ZIEMBA, Faculty of Commerce and Business Administration, Vancouver, B.C., Canada.

Much organizational activity is concerned with the manipulation, storage and communication of data. Data becomes information when it is used for decision making purposes. It is useful information if it alters the decision maker's perception of the true probability distribution of one or more random elements that affect the return or constraints of the decision problem at hand. Information is perfect if it reveals the exact value of these random elements, otherwise it represents partial information. In this paper I discuss methods for calculating the value of partial and perfect information that may be obtained, e.g., from new data collection systems, sampling surveys, expert consultants, etc., in a variety of settings. Throughout it is assumed that the decision maker behaves in a consistent manner when faced with risky choices and hence maximizes the expectation of a utility function over final outcomes. Examples and numerical results from problems in Business, Ecology, Economics, Engineering and Gambling will be used to illustrate the concepts involved and their usefulness and limitations.

Software Engineering, H. D. MILLS (IBM Corporation)

Software began as an afterthought to hardware, and as long as hardware was small and simple, software could be handled informally by scientifically trained people as a byproduct of the use intended for the hardware. As hardware grew in size and complexity, richer software possibilities emerged and software specialists (programmers) appeared, to produce assemblers, compilers, operating systems, data management systems, etc. Although there was an early recognition of mathematical ideas in computing, e.g., in mathematical logic, automata theory, linguistics, etc., the bulk of these software specialists were pragmatic products of computing practice, rather than mathematicians. Thus, although it may seem surprising, the rediscovery of software as a form of mathematics in a deep and literal sense, is just beginning to penetrate university research and teaching, as well as industry and government practices. The forcing factor in this rediscovery has been the growth of software complexity, and the inability of informal software practices and management to cope with it.

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Limits on Scientific Progress

Arranged by NICHOLAS RESCHER (Univ. of Pittsburgh)

Thurs., 16 Feb. / Shoreham / Diplomat

9:00 a.m.-12:00 m.

Some Controversies, Past and Present, about Scientific Progress LARRY LAUDAN (University of Pittsburgh)

One's views about the limits of scientific progress clearly depend, in large part, upon what one believes progress to be. Since the scientific revolution of the 17th century and the industrial revolution of the 18th, friends and critics of science have debated the nature of progress. This paper will briefly survey the range of views about scientific progress, with particular attention to the question whether such progress is primarily intellectual or pragmatic. The chief aim is to show how contemporary issues about progress arise out of a rich historical background.

Progress and Completeness in Science. RICHARD SCHLEGEL (Michigan State University).

Two formal factors limit science: the necessary incompleteness of deductive systems in science and the logical impossibility that symbolic assertions of everything about a system can be made by those within the system. Estimates will be made of the importance of these factors. Properties of the natural world also impose apparent limits; typically, ingenious circumvention of them has led to an expansion of science. But some limits are essential and irremovable: e.g., Heisenberg uncertainty relations, or, possibly, cosmological infinitude. Hence, degree of completeness of science depends in an important sense on what is found by science. In practice, difficulties in procedure, and in degree of human interest, have established completeness goals for a given science and these have sometimes been approximately achieved. Finally, the presence of unexplained first principles brings a limit for scientific knowledge; compensating completeness may be sought in immediate, non-cognitive, and more emotionally laden concepts or experiences. Instances relating to questions of scientific progress will be cited.

Scientific Progress and the "Limits of Growth" Perspective NICHOLAS RESCHER (University of Pittsburgh)

In natural science we do the easy things first. The very structure of scientific inquiry forces us into the situation of an arms-race-reminiscent technological escalation where the frontier-equipment of today's research becomes the museum-piece of tomorrow under the relentless pace of technical obsolescence. The enormous power or sensitivity or complexity deployed in present-day experimental science has not been sought for its own sake, but rather because the research frontier has moved on into an area where this sophistication is the indispensable requisite of ongoing progress. And this means that the "purchase"-price of significant new findings constantly increases. In a zero-growth world in which the resources dedicated to science at any given time are stable (rather than growing exponentially as they have done in the past) this suggests that there may well be a substantial retardation in the pace of scientific progress. The aim of the paper is to explore some of the issues relating to the escalating costs of work at the frontiers of natural science.

The Limits of Science. MARIO BUNGE (Foundations and Philosophy of Science Unit, McGill University).

There are two possible sets of constraints on scientific progress. One is intrascientific, the other social. Intrascientific limitations consist in the impossibility--in principle or in practice--to obtain certain informations or to do certain things. Example: the destruction of geological records. The social limitations on scientific progress derive not only from limitations on human and material resources but also from certain cultural forces. Among the latter ideology is the strongest, since it shapes attitudes and even science policies. Example: unless the current anti-science movement is checked, there is little hope for scientific progress in North America. The sciences of science can do much to either weaken or reinforce such a movement as well as to inspire (right or wrong) science policies.

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The Reception of Unconventional Science by the Scientific Community

Arranged by SEYMOUR H. MAUSKOPF (Duke Univ.)

Thurs., 16 Feb. / Shoreham / Diplomat

3:00 p.m.-6:00 p.m.

The Reception of Acausality. PAUL FORMAN (Smithsonian Institution).

The new quantum mechanics introduced in 1925 was represented by its proponents as an acausal physical theory. I will discuss the role of the Zeitgeist and individual intellectual orientations in the formation of that theory, in the promotion of so thoroughly unconventional a physics, and in the responses to it in Central Europe, Western Europe, and the United States.

The Development and Reception of Continental Drift Theory. HENRY R. FRANKEL (University of Missouri -- at Kansas City)*

During the last fifteen years the earth sciences have been rocked to the core by a conceptual revolution with the acceptance of a sophisticated version of continental drift theory based upon the notions of seafloor spreading and plate tectonics. Continental drift theory was first developed with abundant support by Alfred Wegener during the early teens of this century. Wegener's theory was poorly received by most members of the geological community, and his and other versions of drift theory were almost dealt a death blow during the forties. The dramatic recovery of drift theory occurred during the last fifteen years when novel developments in oceanography and paleomagnetism, coupled with the introduction of seafloor spreading and plate tectonics, led eventually to its acceptance. I argue that beneath the drama involved in the acceptance of drift theory, there is found a rational explanation for why it was accepted when it was accepted.

*Much of the research for this paper was supported by grants from NSF and NEH.

The Reception of Acupuncture. JOHN Z. BOWERS, M.D. (Josiah Macy, Jr. Foundation).

Acupuncture is a technique of Chung-i, Chinese traditional medicine, to which there are references since the middle of the first millenium, B.C. In the practice of acupuncture needles are inserted under the skin at specified points of the body to cure an illness or treat an injury. The skin points are selected on the basis of their supposed relationship to the site of the disorder. The technique is practiced in the Orient and in regions where there are significant numbers of overseas Chinese; in these circumstances it is usually performed by individuals who have had no other training in medicine. Its use in the West was minimal until 1955, when the People's Republic of China began to report remarkable cures in such various diseases as hypertension, poliomyelitis, pnuemonia, and acute appendicitis. The most dramatic development was the use of acupuncture as an anesthetic agent. The Chinese physicians aver that the scientific base for acupuncture is stimulation of a network of channels that connects acupuncture points with the internal organs. Wall and Melzach have proposed a "spinal-gate" theory in which non-pain impulses provoked by the needles jam the gate in the spinal cord, thereby blocking pain impulses from the surgical procedure. A more recent scientific theory is a neurochemical approach, and the role of endomorphins from the pituitary as mediating factors. The reaction of the scientific community to acupuncture continues to be pervaded by skepticism.

The Controversy Over Statistics in Parapsychology
SEYMOUR H. MAUSKOPF (Duke University, Durham, N. C.)

The initial criticism of J. B. Rhine's work in parapsychology by psychologists focused not on experimental method as one might have expected, but on Rhine's use of statistical analysis. Rhine, in response, was able to enlist the support of a group of eminent statisticians by the fall of 1937. The ensuing controversy, which spilled over into the newspapers and the semi-popular science journals, came to a climax at the end of 1937. The controversy involved philosophical and methodological issues concerning the use of statistics in the evaluation of what was highly anomalous data to psychologists but it also had a professional context: experimental psychologists, chary of the use of abstract (and to many, unfamiliar) statistical techniques without experimental justification versus statisticians, only then beginning to find an academic niche for their field, upset at what seemed to be wrong-headed impugning of their field.

Discussion of Papers. MARCELLO TRUZZI (Eastern Michigan University).

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Replicability and Experimenter Influence

Arranged by CHARLES HONORTON (Maimonides Medical Center, Brooklyn, NY)

Fri., 17 Feb. / Shoreham / Diplomat
9:00 a.m.-12:00 m.

The Effect of the Observer in Quantum Mechanics.
HENRY MARGENAU (Yale University)

Two customary assumptions in the quantum theory of measurement are reviewed; certain common errors in them are exposed and corrected. The diversity of an observer's effects upon the outcome of a measurement is illustrated by suitable examples. Next we discuss the question whether an observer can affect the outcome deliberately. A preliminary affirmative answer, based on an examination of the philosophic problems of reductivism and the mind-brain relation is offered. It involves a brief analysis of consciousness and its relation to the measurement process.

Experimenter Effects in Behavioral Research. ROBERT ROSENTHAL (Harvard University)

Two major types of effects that experimenters may have on the results of their research are distinguished: those in which there is no direct effect of the experimenter on the response of the research subject, and those in which there *is* such an effect. The former include observer, interpreter, and intentional effects; the latter include biosocial, psychosocial, situational, modeling, and expectancy effects. Examples of recent studies of interpersonal expectancy effects in laboratories (experimenter effects) and classrooms (Pygmalion effects) are given, and a summary of over 300 such studies is provided. Methods for the control of experimenter effects are summarized as are methods for the systematic, quantitative summary of sets of studies constituting the empirical literatures of the behavioral sciences. Finally, some substantive implications of research on interpersonal expectancy effects are discussed.

Replicability and Experimenter Influence in Parapsychological (Psi) Research. CHARLES HONORTON (Maimonides Medical Center)

While there are as yet no cookbook-style recipes for parapsychological experiments that will work every time or with everyone, a number of psi research areas now exhibit replication rates that are comparable to those reported in more conventional fields of human research. Two such areas, comprising over 100 experimental studies, are surveyed in some detail to illustrate problems, methods, and performance levels. Next, studies are reviewed that address the contribution of experimenter influence to the variability of parapsychological research findings. These include studies of experimenter expectancy effects and their influence on subjects' psi performance, interpersonal effects, and psi-mediated experimenter effects. Expectancy and interpersonal experimenter effects have been found to significantly influence the direction and level of subjects' psi performance. The possibility of psi-mediated experimenter effects cannot be logically excluded and has been directly supported by a small number of research studies. Strategies are discussed for the measurement and control of experimenter effects in psi research. It is suggested that if further research supports the existence of psi-mediated experimenter effects a measurement problem, akin to that in physics, will exist in which psi phenomena, while demonstrable, cannot be precisely isolated to specific individuals i.e., "subjects" in the experimental situation.

Science and the Rule of Replicability: A Sociological Study of Scientific Method. H. M. COLLINS (University of Bath)*

Pre-eminently, the criterion which is taken to demarcate real phenomena from spurious claims is replicability. However, experimental replications must be done competently or false results, either negative or positive, will be produced. Frequently, attempted replications fail, for the ability to conduct any particular experiment rests on the capricious process of acquisition of the corresponding skill. In much 'normal' scientific practice experimental competence is judged by reference to the outcome of experiments. When an experiment fails to produce an acceptable result it is deemed to have been done badly. In contentious areas, where the correct outcome of experiments is in dispute scientists may disagree about those experiments which they consider to be competently performed according to whether they produce phenomena that are believed to exist or not. Thus different scientists may apply the rule of replicability in different ways, which precipitate different sets of natural regularities. In practice then, replicability does not work as a demarcation criterion but rather as the axis of arguments over the existence of and nature of contentious phenomena. These points are illustrated by reference to case studies of laser physics, gravity wave physics, and parapsychology.

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The Rhetoric and Language of Science

Arranged by BEREL LANG (Univ. of Colorado, Boulder)

Fri., 17 Feb. / Shoreham / Board
3:00 p.m.-6:00 p.m.

Implied Audience in Scientific Discourse.
ARTHUR QUINN (University of California,Berkeley)

This paper attempts to show the usefulness of the rhetorical concept of the "implied audience"

in the analysis of scientific discourse. It will do so through the examination of certain aspects of the writings of Russell and Whitehead, Darwin, Newton, and Freud. The implied audience useful in the examination of these writings will often appear not to be the universal audience described by C. Perelman; at times it resembles the "fallen audience" which Stanley Fish found a useful concept in his rhetorical analysis of Paradise Lost.

Technology: The Rhetoric of Change. J.C. MATHES (University of Michigan)

Technology becomes problematic when we lose our shared community of assumptions and values. Goals and impacts of technology therefore become issues between various groups of users, consumers, clients, and victims of technology. To resolve such issues requires that technology itself be defined as a rhetoric of change. Technology-by definition applied rather than conceptual-must be accepted as a strategy for social problem-solving in which definition of the problem, delineation of contexts, and establishment of mutual credibility among various groups are primary concerns in technology policy and assessment. Adversary rhetoric that objectifies a technology as an event or an object thus is inappropriate and counter-productive.

Neutral Description: A Terminal Fallacy. GARY STAHL (University of Colorado)

Despite the growing agreement that mechanistic and reductive language simply won't work in the life sciences, there is sharp disagreement about the appropriateness of valuative implications in that language; the usual reaction is to call for exorcism in the name of methodological purity. Note, for instance, the discussions of whether certain stages in the development of the species or the individual can be considered "higher" or more "mature," or whether we must rest content with describing the causal matrix, noting what stages are earlier or later. The issue is crucial for any science that intervenes to remove pathologies or promote an alternative state. I want to argue, though, that any language that deals with living systems must be able to make sense of the emergence of form, and of the existence of different, but equally necessary, levels of analysis; for a language which can do this, the emergence of the "person" (with all his moral baggage) from the organism is simply another level of form, another dimension of significance. Methodologically, the move to the ethical is no big deal.

14. SCIENTIFIC FREEDOM AND RESPONSIBILITY

Appraising Peer Review

Arranged by HARRIET ZUCKERMAN (Columbia Univ.)

Mon., 13 Feb. / Shoreham / Board

9:00 a.m.-12:00 m.

NIH Grants Peer Review - Present and Future RUTH L. KIRSCHSTEIN, M.D., (National Institute of General Medical Sciences, National Institutes of Health)

The Grants Peer Review Study Team, a group of NIH health scientist administrators was appointed by the Director, NIH in 1975 to study the peer review system. Analysis of the comments and suggestions solicited from the scientific community, led to certain conclusions and recommendations.

First and foremost, the NIH grants peer review system is the single most effective means for assuring support of biomedical research of the highest quality.

Second, the system can be strengthened by a series of modifications which will allow greater participation of the scientific community at large. These include:

o Announcement periodically of all upcoming vacancies on study sections and a request for suggestions from the scientific community of qualified candidates for these vacancies.

o Procedures for an investigator to suggest both the appropriate study section to which the application should be assigned and outside reviewers who are knowledgeable about the particular area of research.

o The routine distribution of the summary statement associated with a grant application to the investigator who submitted that application.

o The development of a formal grants peer review appeals system headed by an NIH "ombudsman" to whom an investigator can turn for advice and to present a rebuttal.

The goal of these modifications is the improvement of the peer review system and thus of biomedical research.

A Citation Study of The Peer Review Process. GRACE M. CARTER (The Rand Corporation).

The average priority score given by NIH peer review groups to renewal applications improved over time compared to new applications. These trends are due to the effect of increasingly tighter budgets during the early part of the period causing funding higher quality grants and therefore renewal applications increased in quality during subsequent years. The disapproval rate of renewal applications has been declining more than can be explained by increased quality, or bias in favor of existing grants (disapproval rate for new applications also declined), or self selection (the rate at which grantees applied for renewal was unchanged). The probability that a grant will publish a frequently cited article is related to the priority score received on the application, but is more strongly related to the score received on an application to renew the grant following publication. The correlation coefficient between the score received on a renewal and the score received the previous time the grant was reviewed is 0.4. This low value can be explained in part by the output produced during the previous grant period. These observations are consistent with the existence of a good deal of uncertainty in judgments of proposed research and adap[illegible] the second study section to the merits of the resea[illegible] away from the earlier appraisal of its potential [illegible] projects receive a slightly better score than renewal applications with the same citation rate. Applications from younger investigators receive better scores.

(Supported by MD-24196, OD-5-2127.)

Peer Review at the National Science Foundation. STEPHEN COLE (SUNY Stony Brook), JONATHAN R. COLE, (Columbia University).

Recently, the peer review system at the National Science Foundation has been criticized within Congress and within the scientific community for using unfair criteria in making funding decisions. Consideration of the charge that an "old boy" system exists, which is biased in favor of elite scientists at the most distinguished science departments and laboratories, is the point of departure for this empirical study. Data were collected on the NSF peer review system, including: 75 in-depth interviews with members of the administrative hierarchy, from program directors to the Director of the Foundation; data on 1200 applicants to 10 basic science programs (approximately 600 awards and 600 refusals); data on the status characteristics, past funding history, and track-record of both the applicants for grants and the peer reviewers who appraised the applications; data on the substantive content of the peer reviews and the adjectival ratings given to proposals. Preliminary analysis of the data suggests that the peer review ratings are by far the strongest predictor of the funding division. Accordingly, the focus of this paper shifts to the determinants of their ratings. We consider the following questions. Is there evidence that an old boy network influences the peer reviews received by the HSF? What is the relationship between characteristics of applicants, characteristics of reviewers, and the peer review ratings that proposals receive? Specifically, to what extent do track record, age, geographic region, department prestige, inter alia, influence the probabilities of receiving high ratings?

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Participation and Expertise in a Democratic Society

Arranged by DOROTHY W. NELKIN (Cornell Univ.)

Mon., 13 Feb. / Shoreham / Executive
3:00 p.m.-6:00 p.m.

The Concept of a Citizens Court. SHELDON KRIMSKY (Tufts University)

The paper examines the review process undertaken by eight citizens comprising the Cambridge (Mass.) Experimentation Review Board. This board, charged with assessing the risks to the community of recombinant DNA research, was a first approximation to a citizen court. The paper discusses the preconditions for the successful application of the model and compares the concept of the lay citizens court with that of the more publicized science court where the jurors are people with recognized scientific credentials. Special attention is given to the selection and education of the citizenry and the problem for lay board members of sorting out established fact from speculative hypotheses.

Airing Technical Disputes: A Case Study ALLAN MAZUR (Syracuse University), ANDREW MARINO and ROBERT BECKER, (Veterans Administration Hospital, Syracuse)

Several mechanisms (arbitration, the "science court", etc.) have been proposed to resolve technical experts' disputes over policy-relevant matters. Nearly all require some sort of exchange between the experts to separate points of agreement from points of disagreement and, where disagreement exists, to juxtapose conflicting data and arguments. We attempted to promote an exchange in the dispute over possible harmful effects from the electromagnetic fields of high voltage transmission lines, using the science court mechanism. This was not a full blown science court, but we did attempt the preliminary steps of the procedure. Here we address three questions which are relevant to a science court and to many other resolution mechanisms which have been proposed: (1) Can one easily locate technical experts on both sides of the dispute? (2) Can one easily obtain from such experts statements of relevant alleged fact which are testable by empirical means? (3) Will these experts participate in a public exchange, in this case, in the format of a science court? We were able to locate experts who were widely recognized as major proponents of each position. We identified several disputed facts, stated as testable hypotheses, that seem relevant to policy decisions about electric transmission lines. However, experts on the "industry side" of the controversy were reluctant to participate in a science court, or in any direct public exchange, with experts opposing transmission lines.

Technical Advice and the Democratic Paradigm. JEROME E. MILCH (Cornell University).

The relationship between scientific knowledge and political power continues to attract attention in democratic societies. Although a number of recent studies have pointed to a growing skepticism about the objectivity of scientific and technical advice, significant segments of the scientific community, the policy elite, and the public at large believe in the feasibility of procuring unbiased scientific and technical information to facilitate rational decision making. This paper examines some of the factors which have helped perpetuate this belief and its consequences for the political process. The predominance of technical modes of discourse on policy issues, it is argued, is a more significant problem for democratic societies than the misuse of scientific advice, for it is deeply rooted in American political culture and, therefore, less amenable to resolution through structural changes.

Public Input in Technical Decision-Making In Two Federal Agencies. DANIEL METLAY (Indiana University).

In this paper, we examine public participation in decision-making in Federal scientific regulatory agencies. First, the various mechanisms for participation are described. Second, two case studies of public participation are analyzed. One case deals with the Nuclear Regulatory Commission's decision on the recycle of plutonium in light water reactors. The other treats the Food and Drug Administration's decision to approve diethylstilbestrol (DES) as a post-coital contraceptive. Finally, we specify the conditions under which public participation is likely to be effective. An effort is made to sketch out a theory of public participation in agency decision-making.

Participatory Experiments in Several European Countries. DOROTHY NELKIN, (Cornell University).

This paper compares the efforts to broaden public involvement in energy decisions in Sweden, The Netherlands, and Austria where nuclear policies have faced opposition. The comparison reveals how participatory reforms develop as a means to win acceptance of controversial government policies; how the shape of these reforms reflect different political expectations about the function of citizenship and the role of government; and how perceptions of the problems of participation vary according to national political objectives.

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Science and the "Isms" of the 20th Century

Arranged by ROBERT E. FILNER (San Diego State Univ.)

Tues., 14 Feb. / Shoreham / Tudor
3:00 p.m.-6:00 p.m.

Science and Marxism: The Social Relations of Science Movement in England. ROBERT E. FILNER (San Diego State University).

During the 1930s and 1940s, the rush of events--worldwide economic crisis, the emergence of radically new political forms in Russia and Germany, world war, cold war--shook traditional outlooks and stimulated a new and dramatic response from a major section of the English scientific community on such questions as the social and political responsibility of the scientist, the relations between science and society, the organization of science. The development of that response into a coherent and influential political and intellectual movement, the "Social Relations of Science" movement, and its conflict with an organized effort to sustain traditional values, are the subjects of this paper.

The Social Relations of Science movement had significant impact not only on contemporary England but also on postwar Europe and America. That impact--on the general public, on the scientific community, and on politicians--will be analyzed around four major themes: the organization of science, the nature of the relation between science and society, the history of science, and the social and political responsibility of the scientist.

Science and the Fascist State. JUDITH R. GOODSTEIN (California Institute of Technology).

Fascism is one of the basic political themes of this century. What were the symbols of Fascist culture while Mussolini was in power? Two prominent institutions served as symbols of scientific culture in the Fascist State: the Royal Academy of Italy and the National Research Council. Mussolini appointed Nobel-prize winner Guglielmo Marconi head of both organizations. Aside from this recognition accorded to Marconi, how did the Fascist State treat its scientists? Did this particular group of intellectuals figure in the Duce's plan to make Italy a powerful nation ? What evidence is there to support the charge that some of its best scientists became, "important executors of Fascist politics?

The High Cost of Ideology: Physicists and the Political Environment in Nazi Germany.
ALAN D. BEYERCHEN (University of Florida).

In his recent book Scientists under Hitler: Politics and the Physics Community in the Third Reich (Yale University Press, 1977), the author has shown that the seizure of power by the National Socialists in 1933 confronted the German physics community with a host of problems, the most immediate of which was how to minimize the effects of the expulsion of the Jews from academia. Nazi efforts to align the universities with the regime and assaults upon the leadership of the community by the self-proclaimed "Aryan physicists" also posed serious threats to the conduct of professional science. In response, most of the leaders among the physicists counseled at least limited, passive cooperation with the government in order to preserve as much professional autonomy as possible.

Within this context, the author focuses on an outspoken exception to the rule, namely Max von Laue. As president of the German Physical Society in 1933 and vice-president in 1934 and 1935, von Laue refused even the appearance of compromise, strove to aid the Jews, and resolutely opposed all efforts to wrest control of the discipline from the professional community. But despite his forceful stand, even von Laue was at times uncertain whether he, as a scientist, should become involved in political issues. The paper concludes with an assessment of von Laue's views and the effectiveness of his actions compared with those of his colleagues.

Science and Internationalism: Foreign Defenders of Kapitza and Sakharov.
LAWRENCE BADASH (University of California, Santa Barbara).

On a visit to his homeland in 1934, Peter Kapitza, who had worked in Rutherford's Cavendish Laboratory for over a dozen years, was told by Kremlin authorities that he would not be permitted to return to England. Instead, a new laboratory would be built for him in Moscow. Nearly four decades later, in 1973, Andrei Sakharov, prominent for his major contributions to thermonuclear weapons, was reviled by his government for his outspoken defense of civil liberties, and threatened with prosecution on apparently fabricated charges. In both cases their scientific friends abroad campaigned on their behalves: personal letters to Soviet officials, petitions, public protests, efforts to secure intervention by friendly governments, threats to future scientific cooperation, and pleas to respect the internationality of science all found their advocates. For Kapitza, none of these was effective. Sakharov's defenders were more alarmed about his fate--the charges against him were serious--and more attuned to political action. That the Kremlin took no measures against Sakharov suggests they deserve some credit. Similarities and differences in the two examples, and reasons for opposite outcomes, will be analyzed.

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Whistle-Blowing and Scientific Responsibility: The Management of Technical Dissent

Arranged by FRANK VON HIPPEL (Princeton Univ.) and ROSEMARY A. CHALK (AAAS)

Wed., 15 Feb. / Shoreham / Palladian

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Whistleblowing: Contribution or Catastrophe
CAROL S. KENNEDY, M. D. (Former FDA Psychiatrist)

In August 1974, 14 present and former professionals and consultants gave sworn testimony concerning their experiences with the FDA. Several discussed scientific issues and personnel abuses involving the Division of Neuropharmacology, responsible for monitoring some of the most financially profitable drug entities. Of major concern were the secrecy surrounding the drug review process, alteration of Agency documents by supervisory personnel, exclusion of reviewers from Agency-Industry meetings, and removal of specialists from areas of expertise. The August hearings resulted in a series of costly investigations which failed to address many of the specific scientific issues, but revealed that FDA Management engaged in a systematic pattern of involuntary transfers of professionals labeled as adversarial. Testimony during July 1976 hearings before the same Senate Subcommittees elicited suggestions for achieving necessary and effective changes. Vital issues such as clinical safety and efficacy data should not be considered "trade secrets" since scientific literature and medical decisions are based on that data. The shroud of secrecy must be removed from FDA's decision making processes and FDA officials must be held publicly accountable to assure responsible and scientifically based decisions. Vigilance must be maintained on the quality of scientific research. This requires careful clinical studies and monitoring. Industry, FDA and the scientific community share the responsibility. Unless effective change is instituted the scientific and public interest cannot be truly served.

An Administrator's Perspective.
MARC NOVITCH (Deputy Assoc. Commissioner of Medical Affairs, FDA).

A Congressional Perspective.
LARRY HOROWITZ (Staff Director, Subcommittee on Health and Scientific Research, U.S. Senate).

A Reviewer's Perspective: Lessons from the HEW Review Panel on New Drug Regulation.
NORMAN DORSEN (New York University School of Law)

In August 1974 certain employees of the Bureau of Drugs of FDA made allegations of improper conduct and internal management before two Senate subcommittees. They alleged that industry pressure had influenced FDA's drug review process, that the witnesses' efforts to disapprove new drugs had met with resistance and harassment, and that they had been removed from drug reviews, or transferred from their areas of specialization, in retaliation for recommending nonapproval. The hearings resulted in unfavorable publicity for the agency and in severe criticisms of the persons making the allegations in trade publications. Although FDA Commissioner Schmidt believed the hearings were unfair, he nevertheless undertook an investigation. He found that the general accusations against the integrity of the agency were unsupported, although some agency actions were procedurally improper. Subsequently, the Secretary of HEW's Review Panel on New Drug Regulation determined that the Commissioner's investigation was inadequate. The Panel thereafter conducted a reinvestigation of several important allegations. It concluded that some allegations were borne out and it made recommendations to prohibit repetition. Here are the findings.

Nuclear Safety - Whose Responsibility?
RONALD M. FLUEGGE (Shoss Radiological Group, former NRC Reactor Engineer)

One of the purposes of the Energy Reorganization Act of 1974 was to assure the Nation, by the separation of the regulatory and developmental aspects of nuclear power into two agencies, that the development of nuclear energy would proceed with the best assurances of safety to the public, enforced by top-quality regulation. However, the NRC has withheld from the public certain NRC staff technical analyses on a wide range of unresolved nuclear safety issues, and that the NRC gives assurances to the public regarding the safety of nuclear power plants while lacking an adequate technical basis. The NRC management let its commitment to the industry and Administration goals for nuclear power expansion compromise the Agency's regulatory integrity. When staff members of an agency dealing with public health and safety are concerned enough to bring forward such issues

to a Committee of the Congress in a responsible manner, then that is reason enough for Congress and the public to hear the specifics.

Technical Dissent in the Nuclear Regulatory Commission
ROGER J. MATTSON (Nuclear Regulatory Commission)

The NRC has responsibility for regulating nuclear power to protect public health and safety and the environment. We have a multistep licensing process for the review of proposed power plant designs and sites by our staff of engineers and scientists. We expect and encourage our people to speak their best judgments in carrying out the review. Our large staff encompasses a broad range of technical specialties and is a fertile breeding ground for diversity of viewpoints; so individual views do not always prevail in the final analysis. Diversity is healthy and our process is designed to take advantage of it. However, on several recent occasions there have been public charges of suppression of dissent. These have led to policy statements and procedures to formalize the previous open door policy and guarantee the right of employees to be heard in any office of the NRC, or at the Congress, without recrimination or retribution. We emphasize that it is not only the right, but the duty, of employees to make known personal views of unsafe practices. We strive to treat differences of opinion routinely and professionally. Expressions of serious unresolved differences in opinion are publicly documented and answered in the licensing process. While there is some discomfort with the burdens this imposes, we recognize that free expression strengthens technical judgment, and the public interest is served by the thorough ventilation of scientific opinion.

A Congressional Perspective. HENRY R. MYERS (Special Consultant, Nuclear Energy, Committee on Interior and Insular Affairs, U.S. House of Representatives).

Common Factors in Scientific Dissent, ROBERT J. BAUM (Rensselaer Polytechnic Institute).

This paper will begin with an analysis of the two cases presented in detail in this symposium to identify what, if any, special responsibilities are shared by scientists and engineers employed by governmental agencies, and what special problems they may have in expressing dissenting professional opinions. A detailed analysis will also be provided of similarities of responsibilities, rights and problems related to dissent shared by scientists and engineers in non-governmental employment contexts such as private corporations and universities. Comparisons will also be made with cases of dissent within the academic science community where there were no significant general social or political factors involved (e.g., Wegener and Velikovsky), in order to identify difficulties in dealing with dissent from a technical point of view, as well as to emphasize the political elements of the scientific process itself. It will be suggested that while the involvement of professional societies in cases of dissent in governmental agencies could be a major source of assistance, it could equally well result in the dissenting scientist or engineer having to struggle against the scientific establishment as well as the government, unless the role of the scientific organizations is carefully restricted. Suggestions will be made as to the ways in which scientific societies should and should not become involved in these cases.

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Regulation of Scientific Inquiry: Societal Concerns with Research

Arranged by HANS O. MAUKSCH (Univ. of Missouri, Columbia) ROSEMARY A. CHALK (AAAS) and KEITH M. WULFF (Concordia College, Moorhead, MN)

Thurs., 16 Feb. / Shoreham / Palladian

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

The Ethical Dilemmas of Biomedical Research. ANDRÉ E. HELLEGERS (Kennedy Institute, Georgetown University).

Value Conflicts in Restricting Scientific Inquiry. BARRY M. CASPER (Carleton College, Northfield, Minn.)

Secrecy and the Individual in Sociological Research. KURT W. BACK (Duke University).

Privacy Regulations and Longitudinal Studies. LEE N. ROBINS (Washington University).

Conditions for and Consequences of Human Subject Consent in Research. ALBERT J. REISS, JR. (Yale University).

Regulations of Research as Factors of Accountability and Power. HANS O. MAUKSCH

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Human Rights and Scientific Freedom: Are Scientists Special?

Arranged by JOHN T. EDSALL (Harvard Univ.) and JOEL R. PRIMACK (Univ. of California, Santa Cruz)

Fri., 17 Feb. / Shoreham / Palladian

9:00 a.m.-12:00 m.

Human Issues in Human Rights: The National Academy Committee's Experience. ROBERT W. KATES (Clark University)

To be active in defense of human rights is to confront human issues both disturbing and difficult. For two years, a Committee of the National Academy of Sciences has sought to develop a sustained program of human rights activity appropriate to its membership and its tradition of concern for the rights of scientific workers.

The selected program focuses on the plight of individual scientists, engineers, and medical personnel suffering severe repression. The Committee, with strong staff support, makes preliminary inquiries into cases brought to its attention. When a clear-cut case of severe repression is established, the Committee with the aid of a correspondent network of 330 Academy members engages in a program of public remonstrance, appeals to the concerned government, and offers moral support to the individual and their families. Currently inquiries and other efforts are being directed in behalf of individuals in seven countries.

In developing this activity, members of the Committee had to engage a series of troubling issues. These include issues related to the nature of human rights in general and the rights of scientists in particular, as well as issues related to action, including the choice of cases and the format of protest. But most troubling of all are the issues raised by the profound distortions of humanness, nationhood, and science that follow in the wake of repression.

The AAAS Committee's Experience: The Situation in Argentina as an Example. JOEL R. PRIMACK (University of California, Santa Cruz).

The AAAS Committee on Scientific Freedom and Responsibility is charged, among other things, with "maintaining a current awareness of policies and actions of the governments of the United States and other nations which circumscribe scientific freedom and responsibility, including restraints upon the admission of scientists to attend scientific meetings or pursue professional opportunities".[1] This talk will review the activities of the subcommittee on Infringements of Scientific Freedom in Foreign Countries during the past year, which have included establishment of a clearinghouse for information on foreign infringements of scientific freedom;[2] sponsorship of a Workshop on Scientific Freedom and Human Rights;[3] and investigation of a number of specific instances of violations of scientific freedom, particularly in Argentina.

[1] Science 193, 877 (1976); ibid. 194, 1036 (1976).
[2] Science 195, 245 (1977).
[3] Science 197, 40 (1977).

Soviet Scientists: Property of the State

MARK S. MELLMAN (Committee of Concerned Scientists)

The Soviet Union is propounding a new and dangerous vision of the scientist as property of the state. This notion has profound and destructive consequences not only for individual Soviet scientists who take actions which the government views undesirable, but for the entire international scientific community.

As a result of legally requesting permission to emigrate, Soviet scientists are ostracized by the Soviet scientific community. They are dismissed from their academic and research posts. They are also prevented from publishing their work in Soviet journals and attending conferences and seminars. These "refusenik scientists" also suffer innumerable harassments in their personal lives.

Western scientists have both personal and professional reasons for protesting the denial of scientific and human rights to colleagues abroad. On a personal level, the violation of the rights of any individual must impel men of humanitarian ideals to raise their voices in protest. Scientists also have an equally important professional reason to voice their concern in matters of this sort. When a scholar is prevented from having normal contact with colleagues, it is an impediment not only to his own work, but to that of his colleagues as well, and hence to scientific advancement in general.

Unlike many other groups in society, scientists have direct and effective channels through which to make their views known and felt. The channels of communication which detente has opened can and should be used by US scientists to protect rights of colleagues abroad.

Congressional Human Rights Activities: How Can Scientists Respond? ROBERT F. DRINAN (Member of Congress).

Within the past few years, there has been a dramatic increase in Congressional concern for international human rights. The Harkin Amendment and similar versions thereof prohibit U.S. military and some other forms of assistance to all governments which engage in the systematic violation of human rights.

The scientific community has a special obligation to lend its prestige to Congressional efforts to enforce the provisions of recently enacted human rights legislation. Scientists are often among the first victims of government repression, and are among the world's most respected citizens. As we in Congress seek to make human right legislation work, we need the assistance of the scientific community in bringing our case to the American public, the President, and other governments throughout the world.

15. EDUCATION AND OPPORTUNITIES

Issues in Science Education

Arranged by JAMES T. ROBINSON (Biological Sciences Curriculum Study, Boulder, CO) and ARTHUR H. LIVERMORE (AAAS)

Mon., 13 Feb. / Sheraton-Park / Adams

3:00 p.m.-6:00 p.m.

Tues., 14 Feb. / Sheraton-Park / Adams

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Wed., 15 Feb. / Sheraton-Park / Adams

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Science in the Education of the Citizen. HAROLD HODGKINSON (American Management Associations; formerly Director, National Institute of Education).

In the opinion of many citizens on school boards, science education has not justified the large promises made in the 1960's. There is no significant perception that science education in K-12 has improved, even with many millions invested. The "Back to Basics" movement has made some science education seem effete, unrelated to the problems of life, overly theoretical and not "basic" (read hard-nosed) enough. MACOS clearly lost ground with Congress. What is needed now is a thorough rethinking of the curricular issues in science at K-12. Are there generic competencies in science which all must possess in order to earn the high school diploma? Do laboratories work instructionally? How do the various sciences fit together in the name of general or liberal education? How does one build an articulated science program with chances for integration across years and across fields?

Science in Education. F. JAMES RUTHERFORD (National Science Foundation).

There are two useful ways to think about the role of science in education. One is in the sense of science as a research activity, and is the meaning intended to describe the domain of Section Q when it was first established within AAAS. In this context, science in education addresses questions as to what extent and in what ways research can be conducted and applied in order to improve learning. The second meaning has to do with science as content. Here the current question is what kind of understanding of science is appropriate to persons today, to enhance their lives as individual human beings and to enable them to fulfill their citizenship requirements knowledgeably. Both contexts of science in education will be discussed and related.

Federal Policy Issues Affecting Pre-College Science Education. JAMES W. SYMINGTON (Smathers, Symington and Herlong).

The Sputnik-triggered Congressional support of pre-college science education in the 1950's aimed at producing more "hard" scientists to meet the perceived challenge. NSF provided advanced training for teachers and developed a number of innovative curricula. Congress, however, remains skeptical of the social sciences generally and reacted in its last term to citizen complaints about certain curricula support by tightening its controls on funding and its surveillance of course content. Today's challenge is to lay a sound basis for proper future support of all sciences. The ranks of research scientists are growing, but we still need to reach an optimum level of applied technology, particularly in the energy field, without short-changing basic research. Other conflicts remain to be resolved. Environmental problems plague the nation, defiling its beauty and contaminating its health. The skills of women and minorities are still underutilized in the physical sciences. We must above all marshal our full potential of human resources, a challenge which can only be met in the long run by a proper emphasis on pre-college science education.

The Impact of Federal Legislation on Pre-College Science Education - LESTER G. PALDY (State University of New York at Stony Brook)

The legislative programs that authorized the National Science Foundation to support the development of curriculum materials, create training opportunities for teachers, and assist schools and universities seeking to develop cooperative relationships forged an alliance of scholars, teachers and institutions which other nations throughout the world have sought to emulate. Despite recent legislative setbacks, the alliance remains sound and can be counted upon to respond to national needs which will undoubtedly emerge during the last quarter of the 20th century. It is to be expected that legislators with the necessary vision will succeed in persuading their colleagues that federal intervention in the process of science education innovation is appropriate when the schools and private enterprise are unable to overcome market or institutional imperfections that interfere with program development.

The Impact of State Legislation on Pre-College Science Education. ROBERT W. HOWE (The Ohio State University, Columbus, Ohio).

Federal and state legislative action during the last 20 years have had significant impact on education in general, and science education in particular. A variety of state policies, legislative actions, and regulations have a direct effect on science education activities in public schools; these may provide support for science education or may inhibit science education. This presentation will consider patterns of state control of education, the relationship of state and Federal legislation, trends in state legislation, impact of types of legislation and policies on science education, and issues concerning legislative patterns. Emphasis will be given to trends from 1960-1977 and implications of these trends for the future.

Policies to Make a Difference. ROBERT L. SILBER (National Science Teachers Association)

Pre-college science education today needs immediate attention. The problems can be traced to the lack of long-range planning and policies which reflect stop-gap measures. Decreasing enrollments, teacher unemployment, diminishing curriculum revision, the back-to-basics movement, and low student test scores reflect the need for decision making. Today's societal problems require an informed citizenry, placing extra demands upon the educational system. Educators, government, organizations, and citizens must plan together to meet the needs of the future. Policies need to be developed which not only attend to present needs but also reflect the recognition of longer-range goals.

Problems in Pre-college Science Education. THOMAS A. SHANNON (Exec. Dir., National School Boards Assn., Washington. D.C.).

Educational Policies in the Context of Educational Politics. DONALD BARR (Headmaster, Hackley School, Tarrytown, N.Y.).

Re-Examining the Assumptions of Improving Science Curricula and Education in the Public Schools. Fenwick W. English.(NCIL) American Association of School Administrators

Many subjects are undergoing a crisis in the public schools due to declining enrollment, shrinking tax support, and heightened taxpayer resistence. As boards of education ponder staff layoffs within the current division of labor and subject centered school curriculum, subject specialists each argue for the retention of their areas in the curriculum as most important. Each area of the curriculum seeks as much national prestige as possible. Science previously enjoyed a much envied position, from NDEA to ESEA. However, the success of the moon shot and new pressures on school systems have led to greater emphasis on other subjects. Currently it is not known just how much science is being taught or for that matter how much of anything is being taught on a national basis. Dialogue about curriculum is aimed at creating new standards and not in accurately determining what the curriculum really is. This leads to a sort of perpetual series of fads and a search for external pressure to update school curricula because there does not seem to be any adequate or strong enough internal pressure to engage in systematic curricular renewal within school systems. The basic cause is the lack of an adequate management system. By pursuing external sources of influence and concentrating solely upon the teacher and the curriculum as agents of change, the subject area associations have left intact the existing type of management system which is unresponsive to anything but crises.. Let us re-examine this matter as a policy issue.

NSF Case Studies in Science Education--Field Reports from Eleven Districts. ROBERT E. STAKE (University of Illinois)

A report of current teaching and learning of K-12 science was needed by NSF for needs assessment and planning new support programs. A contract with CIRCE, a curriculum evaluation group, called for research using case studies. An ethnographer or educational psychologist made observations for 4-15 weeks in 11 districts across the nation. The circumstances at each site were complex, and resisted simple summary. Still it was seen that the curriculum has been influenced by enrollment drops, diminished funding, by teacher and parent emphasis on "basics" (reading & arithmetic) and by increasing bureaucratic and adversarial relationships within the schools. The widely-observed test score drop may be real, but to teachers it is insignificant, possibly showing the deterioration of support for science education. Strong departments once oriented to college-prep content choose switching to training minimum skills, including reading, or scheduling fewer and smaller classes. Short funding and management decrees force supervisors to present needs for science education in terms of behavioral objectives and minimum competencies, perhaps at the cost of science content. Parents and students ask for courses with more practical, perhaps vocational, aims. Students more than teachers see the wave of the future more in the biological sciences than the physical. Most findings are not surprising, but suggest new and different efforts if the schools are to offer courses of quality and to take advantage of out-of-school opportunities to learn science.

NSF Case Studies in Science Education - Report of National Survey Findings. BETH K. DAWSON (Southern Illinois University School of Medicine)

A study of science teaching and learning from kindergarten through high school was requested by NSF to examine current practices and provide information for planning future programs. "Science" was broadly defined as encompassing mathematics and social studies as well as traditional science subjects. Case studies performed in 11 districts in the United States revealed important issues that formed the basis from which to develop eight scenarios for use in a nation-wide questionnaire survey. Each scenario portrays a situation, often utilizing simulated conversations, to acquaint the respondent with one of the issues. A number of questions relating to each situation, many asking for free responses, are then posed. Scenarios reflect such broad concerns as the effect of budget cuts, reduced enrollments, possible conflict between content and basic skills, use of course objectives and elitism in science. Response groups include district superintendents, principals and teachers from all levels, curriculum supervisors, high school counselors, twelfth grade students and their parents. Case study research and survey analysis utilize vastly differing methodologies and each results in findings that are of interest and importance to the scientific community. Of additional interest, however, is assessment of the ability of survey methods to confirm or disconfirm case study findings and, if possible, to extend their generalizability beyond specific sites.

National Survey of Science, Mathematics, and Social Studies Education: Implications for Science Education. IRIS R. WEISS (Center for Educational Research and Evaluation, Research Triangle Institute)

The National Survey of Science, Mathematics, and Social Studies Education was conducted in the spring of 1977 as part of NSF's comprehensive needs assessment program. Approximately 10,000 teachers, principals, superintendents, and state and local supervisors were included in the sample.

This paper focuses on survey results which have implications for science education, including science course offerings, curriculum usage, teaching techniques, and areas in which teachers need additional assistance. Results are presented separately for four grade ranges (K-3, 4-6, 7-9, and 10-12), three types of community (rural, urban and suburban) and four regions of the United States. Comparisons with results for mathematics and social studies are also provided when these are of particular interest.

Specific questions which will be answered include:

1. What percent of districts, schools, teachers, and students are using "innovative" curricula, including the NSF-sponsored materials?
2. Are teachers using a variety of teaching techniques and materials, or are they continuing to rely on lecture-textbook methods?
3. Are teachers receiving adequate assistance in important aspects of their jobs, including establishing instructional objectives, implementing inquiry approaches, articulating instruction across grade levels, etc.

The Status of Pre-College Science Education, 1977. STANLEY L. HELGESON (The Ohio State University).

The state of precollege science education will be reviewed and summarized for the period 1955-1975. Included will be trends and patterns in enrollment, classroom organization, teaching practices, curriculum and instructional materials, and facilities and equipment. Science teacher education, both preservice and inservice, will be reviewed with respect to certification, programs, and research. Needs assessment activities over the past two decades will be presented for education generally and for science education specifically.

Some Suggestions for Getting More Educationally Relevant Research From Basic Scientists. JAMES G. GREENO (University of Pittsburgh).

An important factor in the long-term influence of research and developmental studies is the development of deeper understanding of the nature of children's thinking and of the processes of learning and teaching. In addition to their concern for sound content in the science curriculum, scientists are concerned with development of a body of sound scientific knowledge about the teaching and learning process. Fundamental scientific progress beneficial to education is likely if recent policy decisions calling for increased support for fundamental research with increased participation of active scientists in planning and selection of projects, are implemented. In addition to providing important utilization of present scientific resources in ways beneficial to education, there is a need for agencies with responsibility for support of educational research to adopt policies that will foster the further growth of scientific capability in directions that will provide continued development of knowledge and understanding needed for increased educational effectiveness.

Demystifying Science for Children. LAURA NADER (University of California, Berkeley).

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New Trends in Interpreting Science to the Public

Arranged by EUGENE H. KONE (Rockefeller Univ.)

Tues., 14 Feb. / Sheraton-Park / Wilmington
9:00 a.m.-12:00 m.

Why it is Important to Hold This Symposium at This Time in Human History. EUGENE H. KONE (The Rockefeller University) Chairman. There is a rising tide of criticism of science reporting in the print and electronic media and, at the same time, a rising demand for more information on the social, political, and ideological implications of science and technology in our society. The science reporter and editor must take many new audiences into consideration in his/her evaluation of news events and news breaks. What are the current trends and portents for the future? Can scientists ever be reconciled to the needs for speed and simplification inherent in news reporting on the dead run? These questions, and also the role of the public relations individual on the university campus and in the scientific society will be appraised. Some say there is no more important problem facing both science and society than clear and accurate interpretation of research and its implications.

The Problems and Possibilities of Reporting About Science in the Daily Newspaper GEORGE ALEXANDER (Science Editor Los Angeles Times and President, National Association of Science Writers)

The Role of the Newsletter in Explaining Trends in Science DANIEL S. GREENBERG (Publisher Science and Government Report.

The Role of the Newsmagazine in Interpreting Science to the Public. PETER GWYNNE (Science Editor, Newsweek Magazine)

The problems and possibilities of reporting science stories for television news shows ROBERT BAZELL (Correspondent, NBC News)

Radio in the National Science Picture. IRA FLATOW (Science Reporter, National Public Radio).

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Meeting Educational Needs Through Broadcasting Satellites

Arranged by FRANK W. NORWOOD (Joint Council on Educational Telecommunications, Washington, DC)

Tues., 14 Feb. / Sheraton-Park / Arlington-Alexandria
9:00 a.m.-12:00 m.

NASA Broadcasting Satellites: Technology and Applications. WASYL M. LEW (NASA), PATRICIA I. BOYCE (NASA).

There are presently five NASA broadcasting spacecraft devoted to societal communications applications: Applications Technology Satellites 1, 3, 5, and 6 (ATS-1, -3, -5, -6), and the Communications Technology Satellite (CTS), a cooperative venture with Canada. Of these, only ATS-5 has not seen extensive service in support of educational applications. The others have provided experimental satellite-mediated services ranging the full spectrum from pre-school through continuing adult and professional education, as well as institutional and curricular management.

There is a quantum jump of capability from ATS-1 and -3, which are audio-only spacecraft, to ATS-6 and CTS, which can provide full-motion, full-color video services. All of these "birds" are capable of interactive utilization. All four are geosynchronous and provide coverage to the 50 United States, although ATS-1 and -6, due to their orbital locations, are less than optimal in the extreme northeast New England area.

Satellites in Regional Medical Education. SCHWARZ, M. ROY University of Washington School of Medicine -(UWSM), JOHNSON, MARION H. (UWSM).

In 1971 the UWSM developed a regional medical education program for the states of Washington, Alaska, Montana and Idaho, known as WAMI. WAMI, which covers five time zones and has students separated by more than three thousand miles, uses four universities without medical schools and 15 communities for educational experiences. To maintain this Program, communication between program participants is imperative and mandates travel. The satellite experiments were undertaken to determine if full duplex audio and color video interactions could meet the communication needs. Experiments conducted include:

1. Administration-Conferences, seminars, interviews and recruitment programs conducted via satellite.
2. Curriculum-Faculty presented entire courses, course segments or enrichment blocks to students, faculty and physicians at sites remote to Seattle.

3. Health Services-Faculty at UWSM acted as consultant in health care for patients at remote sites.
4. Evaluation-Attitudes, knowledge acquisition and behavioral changes of students, faculty, patients and administration were monitored.
5. Public Policy-Role of satellites being used in legislative hearings, conferences and discussions between public officials.

Outcomes suggest that interactive satellite communication has broad applicability in medical education but must be accompanied by the development of program and personnel. HRA Contract #231-76-0012; Lister Hill Center of the NLM.

Satellites in Graduate Level and Continuing Education for Engineers and Scientists. KENNETH S. DOWN (Stanford University).

Some 30 major North American universities have media-based systems which provide graduate level and continuing education to employed engineers and scientists at their work locations. Broadcast satellites are making it possible for these courses to be delivered far beyond traditional boundaries. It is anticipated that curriculum sharing among major universities will grow at a rapid pace as operational satellite-based delivery systems are put into place. A curriculum sharing experiment conducted in 1976-77 between Stanford University in Northern California and Carleton University in Ottawa will be described and results of a comprehensive evaluation will be reported. Plans for future use of satellites to deliver engineering education on a broad scale will be reviewed. A suggested table of ingredients for successful use of satellite-based systems will be presented.

Appalachian Education Satellite Program - A Supplemental Regional Learning Program. DR. HAROLD E. MORSE (Appalachian Regional Commission

After an experimental program that produced four graduate courses to teachers in Appalachia via the ATS-6, the Appalachian Regional Commission and the National Institute of Education received with local and State users the applicability of the AESP model to a broader and more diverse constituency.

The new expanded AESP has expanded the number of sites from 15 to 45, expanded the curriculum and has developed a graduated fiscal system that will put the funding of this program on a sound non-Federal basis.

Initial reports show that various institutional and technical barriers have been identified and generally removed to make this program a potential new and fiscally supported supplemental Regional community services program.

Satellites for Public Service: Experiments to Operation. JOHN P. WITHERSPOON (Public Service Satellite Consortium)

The principal utility of a satellite is to make feasible the development of services which are not otherwise possible, not just to provide a means of moving conventional terrestrial services. Decrease in the cost and complexity of earth stations will mean new or improved service for users and broad new markets for carriers and suppliers. If technology is to be used effectively in public service, it is necessary to start with an early marriage between the technological idea and the aggregated requirements of users. The process of adoption by the users will take time because organizational and budget arrangements are hard to change. We need to integrate the technology with practical service requirements and the organizational infrastructure. There must be established from the beginning a clear process by which the service will be offered at a defined cost which should be tied to operating budgets. One opportunity to realize the potential of this new technology will be the Hughes communication satellite, Syncom IV, to be launched by the space shuttle in 1980.

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Communication with Science's Publics: Prerequisite to Public Support

Arranged by HAROLD F. OSBORNE (U. S. Veterans Administration, Bethesda, MD)

Tues., 14 Feb. / Sheraton-Park / Wilmington

3:00 p.m.-6:00 p.m.

Interpersonal Linkage Between Scientists and Non Scientists. ALBERT ROSENFELD (Saturday Review.)

Changing Perceptions of Scientists as Infallible Sources of Knowledge. ALTON L. BLAKESLEE (Associated Press.)

Scientific Hubris: Barrier To Understanding. LEWIS THOMAS (Memorial Sloan-Kettering Cancer Center.)

Consumers, Reporters and the Establishment. MICHAEL J. O'NEILL (New York News.)

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Early Intervention: Matching Programs to Children

Arranged by BERNARD BROWN (Office of Child Development, Washington, DC)

Wed., 15 Feb. / Sheraton-Park / Wilmington

3:00 p.m.-6:00 p.m.

Early Intervention: Who Benefits Most? IRVING LAZAR (College of Human Ecology, Cornell University, Ithaca, New York)

The experimental and control groups in twelve independent longitudinal studies of infant and preschool programs for disadvantaged children which were begin over a decade ago have been compared using individual and pooled analyses. The analysis has produced evidence that early education can yield significant benefits for low-income children. This paper will explore the relationships among outcome measures and the characteristics and backgrounds of the children. Relative effectiveness of intervention will be related to variables such as family configuration, SES, and IQ. Interactions between individuals and program variables (e.g., age of intervention, type of delivery system, etc.) will be described. Implications of these findings for the design of preschool programs will be discussed.

Early Intervention Delivery Systems and Child Outcomes
RUTH HUBBELL (Family Impact Seminar,George Washington University)

Results are reported from a sub-analysis of the Developmental Continuity Consortium Study in which data from fourteen early childhood educational intervention studies were pooled. The effects of the intervention delivery systems (home-based, center-based, or combination-home-and-center-based) on child outcomes are presented. Outcome measures include immediate IQ post-test results as well as findings on special education and grade failure identified in a ten-year follow-up study.

Long-Range Effects of the Parent Education Program. IRA I. GORDON (University of North Carolina at Chapel Hill)

Longitudinal studies of the families in the Parent Education Program indicate significant differences between experimentals and controls on home environment variables at least three years after the program (when the home environment was last measured), and between experimentals and control children as late as third grade when data were last collected). In addition, a fundamental question addressed is the relationship, within the treatment group, of family process and attitudinal variables upon the intellectual and achievement performance of the children in the treatment group. There are clear indications of the influence of family variables on child performance. Implications for program development and research will be presented.

Relationship of Preschool Attendance and Longitudinal Outcomes. DAVID P. WEIKART (High/Scope Educational Research Foundation, Ypsilanti, MI 48197)

Initial results from exemplary preschool programs in the early 1960s were highly encouraging and suggested that preschool programming could significantly ameliorate the effects of early disadvantaged social status upon participating children. Subsequent follow-up data question that initial finding. Recently, however, longitudinal data on the early research indicate that indeed, while not as simple a relationship as originally thought, well operated preschool experiences can have major impact upon the participants. This paper examines the question of the relationship of preschool attendance upon outcomes in social, intellectual, and academic areas in elementary school and junior high school. Highly significant effects are found especially as they relate to grade and class placement. Preschool graduates are more frequently placed on grade level and less frequently assigned to special education classes. This finding has massive cost implications for the public schools and indicates a general improvement in the mental health of the preschool graduates. Further evidence of success is expected to be found in post high school assessment of the preschool graduates.

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Culturally Based Science Education: Needs and Strategies for Science Literacy

Arranged by RAYNA D. GREEN (AAAS)

Wed., 15 Feb. / Sheraton-Park / Arlington-Alexandria

9:00 a.m.-12:00 m.

An Ethnoscientific Approach to Science Education: An Overview. RAYNA D. GREEN (Project on Native Americans in Science, AAAS).

Traditional Science and Appalachian Education. ELIOT WIGGINTON (Exec. Dir., The Foxfire Foundation, Rabun Gap, Ga.)

Latin American Education and Ethnoscientific Strategies UBIRATAN D'AMBROSIO (Universidade Estadual de Campinas, Brasil)

The National Institute for Amazonic Research is producing a book on mathematics and science. It is aimed at giving mathematics and science literacy (both the quantitative and qualitative aspects) to children in the Amazon region. The book is based on their ecosystem, and will draw on daily practices as the source of examples and language. The Institute is seeking to find strategies to place the students in a different cultural and societal environment without displacing them from a rich and still enriching cultural background. We want them to be competitive in facing different sets of values, not to change their values. This presentation will discuss both the programs at the Institute and the strategies staff use in producing curriculum materials for tradition-based children in the teaching of science and mathematics in Brasil.

American Indian Medical Education and Traditional Knowledge. AL GOODMAN (Dir., Education Programs, Navajo Health Authority, Window Rock, Ariz.).

A Basic Science Curriculum Based on Northern Plains Indian Sites. DR. MARY E. BLUEMLE, (University of North Dakota, Grand Forks)

American Indians identify strongly with natural science concepts because their cultures have traditionally reflected the interrelationship between man and nature and man's dependency on nature. Natural science, which deals with all living and non-living things, includes such diverse topics as geology, climatology, soils, astronomy, and biology. A well-integrated course should enable students not majoring in science to gain a balanced perspective of the essence of natural science and its importance to them.

The need for natural science field courses is especially acute for American Indian college students. Indian students often find the social environment and value orientation of colleges and universities alien and for that reason they have difficulty adjusting to college life.

A field course, evolving out of the natural science of North Dakota and its Indian Reservations, is a relevant way to learn science. Such an approach assures that Indian students are not fully removed from aspects of their own culture and physical environment; it is a recognition of the importance of Indian culture. A university field course in natural science of the plains provides a logical transition between traditional Indian cultures and value systems and the sciences commonly taught at a university.

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Civil Rights of the Handicapped: Access to Higher Education

Arranged by JACK MARTIN (Univ. of Washington) and WAYNE FORTUNATO-SCHWANDT (AAAS)

Thurs., 16 Feb. / Sheraton-Park / Arlington-Alexandria

9:00 a.m.-12:00 m.

Services for Handicapped Students. PAT MARX (Handicapped Student Services, Wright State University, Dayton, Ohio).

Alterations of Existing Facilities. RONALD L. MACE (Barrier-Free Environments, Incorporated, Fayetteville, N.C.).

An Enforcement Point of View. JOHN WODATCH (Office of New Programs, Office for Civil Rights, Washington, D.C.).

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Post High School American Youth-- Results from Analyses of the National Longitudinal Survey of the High School Class 1972

Arranged by GEORGE J. NOLFI (University Consultants, Inc., Cambridge, MA)

Thurs., 16 Feb. / Sheraton-Park / Madison

9:00 a.m.-12:00 m.

The Design and Intent of the National Longitudinal Study (NLS). ELMER F. COLLINS (National Center for Education Statistics)

In April 1970 educational researchers and administrators met with Federal officials in Washington, D.C. to reflect their information needs and provide guidance to DHEW about a proposed longitudinal data collection activity. The data needs of DHEW and other Federal agencies had to be taken into account also. In addition, four advisory committees guided the NLS planning during its development and implementation. The NLS was designed as a long-term program to determine what happens to young people after they leave high school, as measured by their subsequent educational and vocational activities, plans, aspirations, and attitudes at various points in time. The purpose of the study is to gain better insights into the development of students as they pass through the American educational system, and to develop an understanding of the factors associated with individual educational and career outcomes. The Base Year Survey was initiated in spring 1972. A national probability sample design provided for the selection of approximately 22,000 seniors from 1,200 public and private high schools. Survey instruments included a student questionnaire, a 69-minute test battery, a student record information form, a school questionnaire, and a counselor questionnaire. Followup surveys of the same individuals were initiated in October 1973, 1974 and 1976 (mail followed by personal interviews of nonrespondents) with sample retention rates from one survey to the next of approximately 94 percent. The major areas covered by the questionnaires are: Demographic information, family and background information, education and training, work experience, family status, military service, activities, attitudes, plans and opinions. The next followup is planned to be initiated in October 1979.

Access to Higher Education: How Important are Race, Sex, Social Class and Academic Credentials for College Access? K.L. ALEXANDER (John Hopkins University), G.E. THOMAS (John Hopkins University) and B.K. ECKLAND (University of North Carolina).

This study reports findings from the National Longitudinal Survey of the High School Class of 1972 concerning the influence of race, sex, social class and academic credentials on access to college. Results indicated that academic credentials were prime determinants of college access. However, the degree to which various types of credentials (mental ability, class rank, curriculum) were assets or liabilities to students varied by race, sex and social class. For example, blacks were advantaged in terms of class rank performance and enrollment in academic programs while whites were advantaged on tests of mental ability. Females were advantaged in class rank performance while low SES students were disadvantaged in terms of mental ability tests performance and being enrolled in academic programs. As for the direct influence of ascribed factors on college attendance, the direct effects of race indicated a black advantage while the direct effects of sex varied by race. White males were more likely to attend college than white females, however, no net sex difference in college attendance existed for blacks. Lastly, the direct effect of social class on college attendance was relatively strong for all groups.

Determinants of Female Labor Force Participation, Fertility and Schooling Expectations and Behavior. STEPHEN P. DRESCH (Institute for Demographic and Economic Studies)

A general model is developed relating age at marriage, fertility expectations, anticipated lifetime labor force participation and schooling decisions of young women. Expectations concerning future labor market and marriage opportunities and experiences, reflecting perceptions of localized, social-class-specific conditions currently prevailing, influence individual marriage, fertility, labor force participation and schooling (human capital investment) plans, all of which are simultaneously determined. Various reduced-form versions of this model are then estimated and tested, utilizing data from the National Longitudinal Survey of the High School Class of 1972 and an Institute for Demographic and Economic Studies survey of a sample of 1973 high school juniors. The estimated models are then utilized to interpret recent secular changes in female fertility and schooling behavior, to assess the probable accuracy of and biases in stated fertility expectations of young women, and to predict future changes in female labor force participation and fertility behavior.

Student Financial Aid: Institutional Packaging and Family Expenditure Patterns. ALAN P. WAGNER (Purdue University)

This study analyzes the allocation of student aid by the postsecondary institutions and the family expenditure response to the level and composition of the aid package. From a managerial discretion model applied to the postsecondary institution, financial aid packages are viewed as a means to attract students with attributes that enhance the institutions own objectives. Using multiple regression techniques, I find that factors contributing to the student's financial need are most important in accounting for differences in aid packages. Lower income, greater student costs, or minority racial/ethnic status tend to be associated with larger aid packages containing relatively more grant and scholarship aid and more Federal aid. Student academic aptitude appears to be less influential in the distribution of aid. In a separate part of the study, I use a human capital model to deduce influences on parental contributions for educational expenses. Parental outlays are considered part of the family's educational investment, presumed to be influenced by its expected returns, the parent's ability to pay, and the amounts of financial aid. The NLS data suggest that student aid substituted least for parental support among low income and minority families. Holding the total amount of aid fixed, relatively larger grant and scholarship aid significantly reduced the extent of parental contributions only among low income families.

Post High School Experiences of High School Graduates: Transition to Postsecondary Education or to Work. GEORGE J. NOLFI (University Consultants, Inc.)

A student's decision to enter the labor force or to delay entry and pursue education in the interim is the result of a complex and poorly understood process. The decision process involves the interrelationship of partial or imperfect information and perceptions of the student with family background and past experiences, in the face of local labor market conditions, and with peer and school influences.
Topics dealt with will include: 1) analysis of work experiences and use of labor market intermediaries by those high school graduates who directly enter the labor market, 2) analysis of the expectations students have for future work and the effect of those expectations on current school/work choices, 3) the effect of job expectations on the particular choice of type of schooling by type of institution and subject field, 4) discussion of policy priorities and policy options, 5) general labor market status and participation and the determinants of labor market success, 6) the decision to enter the labor market vs. postsecondary education, 7) factors affecting choice of occupation and choice among job alternatives, 8) how vocational education, career education, and cooperative work experience programs affect work choice and success. The discussion will focus on the outcomes of the analyses, and deal with methodology only briefly.

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Problems and Solutions: Science Education for the Deaf

Arranged by EDWARD CAIN (Natl. Technical Institute for the Deaf, Rochester, NY) and ROBERT MENCHEL (Xerox Corp., Webster, NY)

Thurs., 16 Feb. / Sheraton-Park / Arlington-Alexandria

3:00 p.m.-6:00 p.m.

Science Education for the Deaf - An Overview and the Role Model. ROBERT S. MENCHEL (AAAS/ Xerox Social Leave Program - Office of Opportunities in Science).

The deaf student has a vague and often distorted view of career opportunities open to them, especially in the field of science. Part of the problem is that the students are not exposed to nor aware of deaf people who have achieved success in the sciences. The other part of the problem is that the deaf student is not aware of job opportunities in science because they do not hear people discuss the different job environments in their homes, at school, or in general social conversation.
In order to change the stereotyped ideas of what job a deaf person can do and to encourage those with scientific abilities to follow a career in science, the AAAS/ Office of Opportunities in Science, in cooperation with the Xerox Corp. Social Leave Program and supported by Exxon Corp., set up a project to provide a role model for the handicapped The person in the role model, himself a handicapped scientist, would visit 26 states speaking to the students, their parents, and their teachers.

This paper will present an overview of the project, observations of successful science programs for the handicapped, either in use or in development, and the purpose and need for the role model in science education for the deaf.

Unique Approaches to Development of Technical Sign Vocabulary and Utilization of Interpreters at National Technical Institute for the Deaf. TRACY A. HURWITZ (NTID)

The recent emergence and expansion of postsecondary educational opportunities for the deaf has made it necessary for unification and establishment of guidelines for the standardization and development of technical sign vocabulary, especially in the science and technology areas. It is often difficult for an interpreter to keep in pace with an instructor during a technical lecture when many of the technical words must be fingerspelled. At the same time deaf students often have difficulty understanding a lecture which contains many fingerspelled words. Two major projects designed to provide some of the solutions to the identifiable problems were established at the National Technical Institute for the Deaf. The first project was developed to establish and maintain a technical sign bank which can serve the communication needs of all postsecondary deaf students, their instructors and interpreters. The second project is the comic book approach to train teachers and deaf students to effectively utilize an interpreter in a regular classroom.

Innovations in Elementary Science for Deaf Students DR. DORIS E. HADARY (American University, D.C.), Robert Haushalter, Richard L. Rosenberg(American University).

A comprehensive sequential laboratory science and art curriculum for deaf elementary school children (5-14 yrs old) is one project presently being developed and implemented in both a mainstream situation and special class setting. The curriculum is based on a combination of experiments with emphasis on discovery. The activities are reinforced by parallel art lessons which not only internalize the science experience, but provide the child with a means of communicating his/her feelings, interpretations, and cognitive gains to peers and very significantly, to the teacher. As the children work in the laboratory they are given language cards which identify and relate to the activity and concepts they discover. The children "verbalize" their experience by identifying and relating an activity to a language card and, finally, with expressions in art form. Where necessary, new activities are being designed when concepts in the regular programs are not meaningful for the deaf. In addition to curriculm design, adaptation, implementation, and testing, the project is concerned with designing teacher training programs.
Our present project is proving to be a start in the right direction in the areas of personnel training, curriculum design, design of evaluation instruments, and design of a program that can be integrated into the total curriculum of a mainstream school as well as special centers.

High School Science in Schools for the Deaf. ROBERT WHERLIE (Dir., Science Educ., Model Secondary School for the Deaf, Washington, D.C.).

College Programs in Science for Deaf Students. FRANCIS C. HIGGINS (Gallaudet College).

Asurvey was conducted among post secondary schools having a program for the hearing impaired to determine to what extent science is taught and the degree of success encountered in placing hearing impaired students in this field. Information on special techniques and instructional materials utilized in educating the hearing impaired on scientific concepts is discussed.

Deaf Science Students Among Hearing Students. B. EDWARD CAIN (National Technical Institute for the Deaf, Rochester Institute of Technology).

Deaf students enrolled in traditional college level classes for the hearing have generally needed additional support to reach their educational goals. Services provided for the deaf science student at Rochester Institute of Technology include: interpreting, notetaking, counseling (personal, academic, and career), communication training, co-op and job placement, and social/leadership training. The reasons these services were found to be necessary will be discussed as well as a qualitative evaluation of their success and of ensuing problems.

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Science and the Needs of the Handicapped

Arranged by E. C. KELLER, JR. (West Virginia Univ.)

Fri., 17 Feb. / Sheraton-Park / Arlington-Alexandria

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Research Needs of the Handicapped. ROBERT W. MANN (Massachusetts Institute of Technology).

Science Education Needs for the Handicapped. ROBERT LARSEN (Argonne National Laboratory).

Career Counseling Handicapped Persons for Scientific Careers: A Lifestyle Approach. RICHARD H. JOHNSON, PH.D. Southern Illinois University-Carbondale.

The basic focus of this presentation is on the concept that handicapped persons are unique from each other. As a population, the handicapped are as heterogeneous as the able bodied. If we are to be appropriate in our encouragement of handicapped persons to enter scientific careers, then we must be certain that their lifestyles are in harmony with scientific occupations. A lifestyle approach to career counseling is presented. This approach is called "The Life Career Exploration" which involves a "Life Career Assessment" followed by systematic exploration of occupations and educational majors. The purpose of the procedure is to help handicapped persons become more fully aware of their basic life motivations and to find areas of employment and education that are consistent with these lifestyles. Also, the role that practicing scientists play as models for handicapped persons interested in scientific careers is discussed. Again, the focus is on the reduction of psychological stereotypes which will open the way for competent, capable, enthusiastic, and interested handicapped persons to enter scientific careers.

Technology Assessment of Rehabilitation Techniques. R. A. DUDEK (Texas Tech University, Lubbock).

Technology Diffusion and Service Delivery for the Handicapped. JERRY TUREN (Social Service Research, The Urban Institute, Washington, D.C.).

Technology Transfer for the Handicapped. LEX FRIEDEN (Texas Institute of Rehabilitation and Research, Houston).

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Models of Learning and Their Implications for Science Education

Arranged by JOSEPH I. LIPSON (Univ. of Mid-America, Lincoln NB)

Fri., 17 Feb. / Sheraton-Park / Franklin

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

The Object-Person Dichotomy in Information Acquisition and Its Implication for Science Education DIANE McGUINNESS (U.C. Santa Cruz), K. H. PRIBRAM (Stanford University).

Data on the differences in performance between the sexes in sensory-motor, attentional and cognitive tasks are reviewed. These data describe a communicative female with a bias toward fine-motor aptitude, and a manipulative male biased toward gross-motor activity. Anatomical and hormonal evidence suggest an "effector-bias" theory which can explain how early sensory-motor differences between the sexes interact with brain control mechanisms to give rise to subsequent differences in cognitive abilities.

These two types of aptitude lead to different modes of learning about the environment: Thus males acquire information directly in manipulative action, and females indirectly via communicative processes.

Western science has developed almost exclusively from a male-oriented aptitude, what Bronowski called the "analytic hand". Thus science has become synonymous with the world of objects. Because of this most of the subject matter of science often appears alien to females as both an interest and the requisite cognitive skills are poorly developed. Some possible solutions to this problem will be suggested.

Information Processing Models and Science Instruction. JILL H. LARKIN (University of California, Berkeley)

Information processing models are highly explicit (often computer-implemented) working models of how people perform various tasks. These models "work" in that they actually produce samples of behavior which can be matched against detailed observations of human behavior on the same tasks. The value of such models is that they exhibit explicitly knowledge sufficient to explain how a person performs a task - knowledge which often is not obvious either to the person himself or to a casual observer. Such explicit models can guide instruction which directly teaches effective knowledge and processes. Further, matching students' work against an explicit model of effective performance aids in diagnosing both individual student's difficulties and general inadequacies in instructional design.
I shall discuss information processing work (including my own in physics) which has particularly direct implications for science instruction. Examples include: (1) Studies of skilled performance, for example, recent work suggesting that good problem solvers, working on highly structured problems (geometry, physics), use extensively less structured processes, including setting indefinite sub-goals and constructing qualitative relations. (2) Comparisons of beginners and experts, for example, work on chess (and more recently physics) suggesting that, compared with beginners, experts store knowledge in large closely-integrated "chunks."

Social Factors in Science Education. HARRY C. TRIANDIS (University of Illinois, Urbana-Champaign).

Social factors important for understanding learning will be examined and their implications for science education will be explored. These include norms, roles, the self-concept, perceived expectations of others, interpersonal agreements, conceptions about one's abilities, attributions of success in solving scientific or mathematical problems (e.g. success is due to effort, luck, ability or ease of task), associations with science-related activities, and perceived consequences of such activities. The development of such factors in different cultural environments, institutional and organizational designs which optimize such factors and relationships between students and teachers, as well as student and peers will also be explored. Rewards received from the social environment differ in quantity, and kind (status, information, money, goods, services) and they are valued differentially depending on their availability in a particular social environment and a learner's expectations about receiving rewards. The achievements of peers result in social comparisons. Rewards received by peers and by the learner are compared and feelings of inequity result if the learner sees that own rewards are smaller relative to own accomplishments, when compared with the ratio of peer rewards and accomplishments. Feelings of overcompensation result from perceptions of own rewards as exceeding own accomplishments to a greater extent that peer rewards exceed their accomplishments. Feelings of overcompensation may result in strong effort to increase the accomplishments to match rewards.

Mass Media and Science Education. JOSEPH LIPSON (University of Mid-America)

Most models of learning pay little attention to the effects of mass media and the community upon the individual. This paper will discuss the evidence for and implications of the impact of the mass media and the interplay between those effects and the forces of the community. Some of the propositions to be examined are the following:
- The community exerts a force for conformity upon people.
- The force for conformity is based upon the shaping effect of social interaction.
- The mass media provide dramatic, vicarious experience of great emotional impact.
- Free of the corrective action of social exchange, vicarious experience tends to promote individual tendencies (private psychological growth) that may be at odds with the ideal of the community.
- The mass media tend to erode community authority.
- Television and films can arouse, interest and motivate people in a powerful but diffuse way so that they will engage in other, more systematic activities related to their television experience.
- The trend is and will be for people to become more sophisticated in their television choices.
- The world view of people is affected in important ways by the information and events portrayed in the media.
- This world view affects the direction of learning. The policy implications of the above will be discussed.

Technologies for Information Processing, Knowledge and Learning: Some Potentials for Radical Impact on Science Education. ALLEN NEWELL (Carnegie-Mellon University)

Three separate technologies will be discussed (though all are related to computer science, broadly viewed). The basic hardware and software technology for information processing (computing) is familiar, as is its explosive growth. The technology of how to represent knowledge is beginning to undergo radical transformation, as the interpreters of the knowledge become computers rather than exclusively humans. The technology of how to produce effective learning in humans shows signs (but only signs) of being able to be based on useful cognitive theory of how humans process information. Taking the problem of science education as a case example, we will ask how these three technologies could combine to produce a radical restructuring of society's task of educating its citizens (including professionals) in science. This will require some analysis of what it means for a citizenry to be "educated in science", and what appropriate overall goals might be like. The entire enterprise is of course speculative. Its usefulness lies in dismembering the proposed projection to determine why it might not occur and why it might. The radical instability of the technological developments themselves (even ignoring the surroundings social, economic and political context), makes exercises such as this an effort at discovering latent consequences and opportunities, rather than producing true projections.

The Macroscope of Scientific Education Gregg Edwards (National Science Foundation).

This paper places the scientific education function within the context of the major flows of scientific and technical information and education of the capacity for realistic and effective thought. Thus not only are included the formal channels of schools and universities, but the influence of newspapers and TV, political and entrepreneural participation, familial and volunteer groups. By tracking the time, attention, and information flows through the system, and in/output framework is suggested for examining the contribution and relative impact of the various sectors and an approach is sketched for relating the effects of the system to long-term social goals. A conception of Value-addition for sub-system operation is illustrated for individual, group, and system contributors. Thus, the long-term potentials of virtually free communication and computation are discussed in terms of a more inclusive and "infusive" educational function, and tools of economic analysis (input/output; production functions) might be generalized to help evaluate the needed experimentation.

Limits on Knowledge About Learning KENNETH BOULDING (University of Colorado)

Learning is a process of structuring nervous systems or their equivalents by processes of inputs from outside with self-generated inputs from within the nervous system itself. The neonate nervous system comes into the world with a potential for structuring, but this potential itself may have some kind of structure, as it may be easier to learn some things than others. Learning is the realization of this potential for structure. There is always some significant relationship between the structure of nervous systems as they are created by learning and some kind of structure in the outside world. This correspondence might be called "truth" or perhaps negatively the "error relationship." Transmission accuracy reflects the correspondence between the structure in the mind of the "teacher" and that in the mind of the "learner." Transmission accuracy, however, is not the same thing as truth or freedom from error. Misunderstanding of the error of the teacher may bring the learner closer to truth. The existence of a "real world" introduce an asymmetry into the learning process. If error can be detected erroneous images are unstable and subject to change, where as correct images which corresponds to the real world are much less likely to change. This asymmetry may also apply to values. Formal education is a subculture within which accuracy of transmission form the teacher to the learner is almost inevitably more highly valued than correspondence with truth. The existence of the real world, however, may overcome this bias even the educational system. Methods might be devised institutionally which act to correct this bias.

16. POLICY DEVELOPMENT

Assessment of Technological Risk

Arranged by RICHARD A. SCRIBNER (AAAS) and WILLIAM A. THOMAS (American Bar Association)

Mon., 13 Feb. / Sheraton-Park / Franklin

9:00 a.m.-12:00 m.

Welcome and Purpose of Symposium. EMILIO Q. DADDARIO (President, AAAS; Co-Chairman, AAAS-ABA National Conference of Lawyers and Scientists).

On Measuring Risk and Judging Safety. WILLIAM W. LOWRANCE (Spec. Asst. to the Undersecretary for Security Assistance, Science, and Technology, U.S. Dept. of State).

No matter what the decisional context or process, decisions about hazards involve two different activities: measuring risk, an objective and probabilistic pursuit, and judging the acceptability of that risk, a matter of personal and social value judgement. A prime obligation of both the technical and legal communities is to point out and preserve that crucial distinction. Our society must develop ways to say "We don't know"; this may involve such "uncertainty buffers" as phased introduction of new technologies and establishment of indemnity pools. We must give weight to considerations of reversability, retrievability, and remediability. And we must learn how to change our societal minds. Broad legal and technical guidelines are needed, as as are generic approaches to issues and attempts to intercompare sets of choices.

Assessment of Risks in Pharmaceuticals: A Regulatory Agency Perspective. DONALD KENNEDY (Commissioner of Food and Drugs, Food and Drug Administration).

Modern drugs inevitably entail risk as well as benefit. However, our society has accumulated more hard data on the benefit than on the risk side. The law requires that a new drug be efficacious for something--that it produce some benefit--and that its sponsor get marketing approval. The law also requires proof of safety, which in practice means relative absence of risk under the specified conditions of use and circumstances surrounding the drug's particular benefits. The flexibility incorporated in the process enables FDA to approve a far less safe drug that offers benefits for a serious illness than it would for a safer drug that deals with a relatively minor problem. However, the data which determine a risk assessment are necessarily limited. Since rare events occur rarely, adverse reactions may appear when the number of exposures to the drug is several orders of magnitude larger than in premarket tests. Only in the market place, were real conditions of exposure involving interactions with foods, other drugs, etc. exist, is the complete picture of risks revealed. To counterbalance this risk uncertainty, we need to maintain a closer surveillance over new drugs after they are marketed, restrict the application or environment of exceptionally potent drugs, and develop the capability to rapidly withdraw or further restrict drugs in which unanticipated risks appear. Changes in our drug laws are necessary to make these improvements.

Comments on Technological Risk Assessment by the Judiciary. HOWARD T. MARKEY (Chief Judge, U.S. Court of Customs and Patent Appeals)

That "judges are technically ignorant" may be a "problem" more perceived than real. There is a distinction between correctness of the assessment itself and the correctness of the assessment process. There is a further distinction between the historic judicial process and the risk assessment process. Judges must not think like scientists, but judges must begin to learn how scientists think. The United States Court of Customs and Patent Appeals has long benefited by assistance from young people with degrees in both law and science. Until more judges learn more about how scientists think, it may be useful to employ these young people more widely in the judicial system.

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The Technical Base for Regulatory Decision-Making

Arranged by JOHN M. LOGSDON (George Washington Univ.)

Mon., 13 Feb. / Sheraton-Park / Franklin

3:00 p.m.-6:00 p.m.

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Bureaucratic Maladies and Remedies

Arranged by CAROL H. WEISS and ALLEN H. BARTON (Columbia Univ.)

Tues., 14 Feb. / Sheraton-Park / Franklin

9:00 a.m.-12:00 m.

Bureaucracy and Its Discontents. GRAHAM ALLISON (Dean, Kennedy School, Harvard University).

Decentralization of Government Agencies: What Does It Accomplish? ROBERT K. YIN (The Rand Corporation)

Decentralization of government--i.e., the transference of power from larger to smaller units of government--has been one way of increasing government responsiveness. This is true for *municipal* systems where a city-wide government may be decentralized to subdistrict units (e.g., a school subdistrict), as well as for the *federal* system, where federal responsibilities may be delegated to state or local units (e.g., general revenue-sharing).
This paper reviews the presumed advantages and disadvantages of decentralized units. Evidence for municipal systems is based on an analysis of 215 previously published case studies; evidence for the federal system is drawn from the emerging debate on the new federal role in urban problems. The paper identifies the commonly known tradeoffs with regard to equity, efficiency, and responsiveness to residents'

needs. It also identifies, however, an often overlooked dilemma: public services are functionally organized--e.g., transportation, public safety, education, health, and housing--and different types of decentralization are suitable for each functional area; to the extent that this is true, horizontal integration is extremely difficult. The paper concludes by raising some key policy questions about decentralization.

Competition Among Government Bureaus. WILLIAM A. NISKANEN (Ford Motor Company).

Competition among government bureaus, in the conventional public administration perspective, is regarded as an undesirable condition, and periodic governmental reorganization proposals usually involve a grouping of bureaus providing like services in a single department. This contrasts with the conventional perspective on the organization of the private sector, where competition is usually regarded as the desirable condition. This paper makes the case that competition among government bureaus improves the incentives of senior bureaucrats, increases political control, and increases the information on bureaucratic activities. Some empirical research on the effects of earlier government reorganizations is summarized. The paper concludes with some comments on the probable effects of recent and pending efforts to reorganize the federal government.

Policy Research and Analysis: What Does It Accomplish? Charles E. Lindblom (Yale).

Policy research and analysis accomplishes little, compared to what might be expected of it and compared to claims often made for it. The problem is often identified as one of "Utilization," as though there exists an adequate supply of suitable research and analysis for which the demand (by government officials) is too small. It is plausible to argue, on the contrary, that the supply is inadequate. In part, there is not enough research and analysis, with the result that on many problems researchers have nothing to offer. More important, however, the supply is badly designed--it provides the wrong kinds of research and analysis. Explanations for poor design are many. Among them: 1) research and analysis, as one kind of input into or influence on policy making, is not well adapted to the other inputs or influences; 2) in particular, it is insufficiently partisan--that is to say, not sufficiently adapted to governmental users, all of whom are assigned a partisan role in policy making; 3) it is guided by conventional scientific canons calling for completeness or closure rather than focussed selectively on residual analytical needs that the potential user cannot meet by the alternatives to research and analysis through which he necessarily meets most of his analytical needs; and 4) it is nondiscriminating on another count: namely, through the working assumption that any and all problems are analyzable.

Increasing Political Control: What Does It Accomplish? FRANCIS E. ROURKE (Johns Hopkins University).

Throughout much of American history, efforts to reform bureaucracy sought to depoliticize executive institutions in the United States. It was widely believed that expert administrative personnel could best serve the public if they were protected from political interference. Where this reform movement was most successful, bureaucracies were so thoroughly insulated from external influence as to become virtually independent enclaves of power. In recent years, however, the direction of the reform movement in public administration has reversed itself. The emphasis today is on the need to open the processes of bureaucratic decision-making to greater outside scrutiny and control. This reversal in the thrust of reform efforts reflects a substantial decline in the public's faith in bureaucratic expertise. Various ways of enchancing political control over bureaucratic organizations are now being tried, including provisions for greater public involvement in bureaucratic decision-making, and the strengthening of legislative oversight mechanisms. While the ultimate benefits to be obtained from this new drive to reform bureaucracy are still uncertain, it is already clear that like earlier efforts to de-politicize the administrative process, the current attempt to re-establish political control over American administrative institutions may have quite unanticipated consequences. But if it succeeds, it will create in the United States a style of bureaucracy very different from that envisaged in the classic Weberian model.

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The State of Academic Science

Arranged by HARVEY M. SAPOLSKY (MIT)

Tues., 14 Feb. / Sheraton-Park / Franklin

3:00 p.m.-6:00 p.m.

The State of Academic Science: The NSF Report. BRUCE L. R. SMITH (Columbia University), JOSEPH J. KARLESKY (Franklin and Marshall College).

Recent changes in the levels of support for academic science have aroused fears about the health of university-based research activities. Our survey of university science departments found continuing vitality in the academic science enterprise but also potential future problems. Significant areas of concern include: a shift from investigator-initiated to applied and contract research, a decline in opportunities of status advancement for second-ranked departments, a slowdown in rate of growth for advanced training in certain fields, and a deterioration in scientific equipment available in the universities. A program to alleviate these problems and to improve federal relations with the universities is outlined.

Trends in the Organization of Academic Research: The Growing Role of Centers and Full-Time Researchers. ALBERT H. TEICH (George Washington University)

Considerable concern has been voiced recently over the limited number of new faculty positions that will become available during the coming decade and the threat this situation poses for the vitality of academic science. Several approaches have been suggested which might help ease this problem of "tenure blockage." Among these are proposals that call for a larger role for full-time professional research staff and for expansion of non-departmental centers, programs and institutes (organized research units--ORUs). This paper examines the potential for and implications of such potential shifts in university organization. It looks at the present status of full-time researchers and ORUs in a number of major research universities, at how their status has changed in recent years, and at how the universities themselves are dealing with the changing situation. Finally, it proposes and assesses a number of federal policy options.

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Methodological Issues in Technology Assessment

Arranged by JOSHUA MENKES and G. PATRICK JOHNSON (NSF)

Wed., 15 Feb. / Sheraton-Park / Franklin

9:00 a.m.-12:00 m.

Context of Technology Assessment*
AARON WILDAVSKY (Russell Sage Foundation)

Technology Assessment is viewed as a form of policy analysis in which efforts are made to affect current policies in the light of anticipated future consequences. This paper will cover three relatively neglected areas of assessment. The first is the organizational mediation of technology. What happens to a potential technology is determined not only by its technical feasibility but by what organizations do to slow it down or speed it up. The second area concerns changing concepts of risk, for if total security is demanded there can be no new technology and probably not much that is old. Risk brings us to culture, namely, the relationship between values and social structure. The way we treat technology depends on how we conceive of desirable social relations. Arguments about technology are often disputes over culture. Our thrust is to look upon technology as a social phenomena and to help develop modes of assessment that take this essential characteristic into account.

*This research was supported by the National Science Foundation, Grant ERS 76-82745. Opinions expressed herein are those of the author alone.

Strategy for Technology Assessment*

JOE ARMSTRONG and WILLIS W. HARMAN (Engineering-Economic Systems Department, Stanford University).

To determine what methodological approaches have in fact been used in carrying out TAs to date (as distinguished from the methods discussed in numerous articles on TA), ten assessments were examined in detail and several times that many were explored with less thoroughness. Available documents were analyzed and interviews were carried out with principal investigators and other members of the assessment teams. There was little semblance of use of a standard methodology, and considerable indication that a standardized methodology would not be appropriate. Instead, specific tasks or functions emerge--e.g., projection of technology development, impact assessment, identification of policy implications; for each of these tasks a number of techniques are available. Problems associated with forming an effective interdisciplinary team within a larger organization appear much more severe than anticipated.

*This research was supported by the National Science Foundation, Grant ERP 75-22788. Opinions expressed herein are those of the authors alone.

Methods and Techniques of TA.*

JOSEPH P. MARTINO (University of Dayton).

Technology Assessment (TA) grew out of a perceived need to avoid surprise in the deployment of new technology. This recognition of need led to a search for appropriate methodology. Much of this search involved the attempt to do a TA, inventing methodology as needed. Since the publication, in 1969, of the first formal TAs conducted by the National Academy of Engineering, several dozen TAs have been performed by various academic, industrial and research organizations, under the sponsorship of various government agencies. It is now appropriate to review these completed studies to determine what methodology is available, and how well it has been found to work. This paper summarizes the results of several surveys of completed and ongoing TAs, and presents a synthesis of the current views of the TA community regarding the strengths and shortcomings of available methodology.

*This research was supported by the National Science Foundation, Grant ERS 77-20685. Opinions expressed herein are those of the author alone.

Integrating Technology Assessment.*

Frederick A. Rossini, Alan L. Porter, Daryl E. Chubin, and Patrick Kelly (Georgia Institute of Technology)

Technology Assessment (TA) is the interdisciplinary study of the full range of consequences of technologies and the policy implications arising from them. TAs involve a variety of intellectual disciplines and values perspectives. In this paper we discuss an exploratory study of the integration of TAs. By integration we mean a situation in which every component analysis of an assessment acts as a substantive input into every other analysis. We used 24 large scale TAs sponsored by the National Science Foundation to consider the relationships among factors (including management, social-psychological, and epistemological) involved in the TA process and the integration of the output of TAs as judged from output documents. We identified four social-cognitive frameworks in which integration may take place: common group learning, modeling, negotiation among experts, and integration by leader. We conducted some exploratory experimental sessions using groups of professionals simulating TA teams to study the frameworks more fully. From the study we draw conclusions which may be of interest to TA practitioners and persons concerned with interdisciplinary research.

*This research was supported by the National Science Foundation, Grant ERS 76-04474. Opinions expressed herein are those of the authors alone.

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The Influence of Product and Process Regulation on Technological Change

Arranged by DAVID L. BODDE (TRW Inc., McLean, VA)

Wed., 15 Feb. / Sheraton-Park / Franklin

3:00 p.m.-6:00 p.m.

Long and Short Term Impacts of Environmental Regulations on Research and Development.

JOSEPH T. LING (3M Company).

Short term impact of environmental regulations on R and D concerns improving methods of reducing common measures of pollution such as Biochemical Oxygen Demand, particulate matter, etc. mainly through add-on controls at the end of the production process. Future emphasis on pollution abatement shifts to environmental effects of specific chemicals. Since most chemicals are developed by industry, long term R & D should emphasize a preventive approach to environmental problems. This involves eliminating undesirable elements when new products are being developed, reformulating existing products, changing manufacturing processes etc. Examples will be cited. Public and private sectors must understand the quality of life issue, of which environment is only one part. Otherwise, the long term impact on R & D may mean unnecessary delay in the introduction of new products and technologies, which could affect the overall economic well being of many industries. Part of this task is achieving agreement on determining how clean is clean, for zero pollution or zero risk is unrealistic. Thus, new technologies, not less, will be needed to meet environmental regulations and improve our quality of life.

Government Intervention and Innovation in Industry

WILLIAM J. ABERNATHY (Harvard University), BALA S. CHAKRAVARTHY.

This paper explores the effect of Government intervention in stimulating innovation in industry. Government interventions may be broadly classified in two categories as: 1) technology "push" actions, i.e. actions which seek to create new technologies through direct government investment in R & D; 2) technology "pull" actions, i.e. actions which modify product characteristics through regulation, procurement, etc. While prior work has considered these types of actions, frequently the effect of each category is viewed in isolation of the other. This paper argues that the joint consequences of both types of intervention are important in shaping innovative activity. The framework is illustrated using data from past projects and it is shown to present an interesting hypothesis about the consequences for innovation. Implications for the current state of innovation in the auto industry are discussed in conclusion.

Public Regulation and Technological Change: A Framework for Understanding.

JORDAN D. LEWIS. (National Bureau of Standards).

Technological change tends to be driven by those forces that shape the demand for technology-embodying goods and services. Thus a clear picture of the effects of public regulation on technological change might emerge from an analysis that views each form of regulation (e.g. certification, standards, rate structure) in a market context (e.g., price bahavior, market entry barriers, uncertainty). Pursuit of this approach suggests that different regulatory forms have distinctly different effects on technology. For example, standards regulation has both raised and lowered production costs, while raising entry barriers for some products and lowering them for others. But the anticipation of a mandatory standard in any field may cause uncertainty (what will it be? when will we have it? will the courts reverse it?) which would reduce long-term private investments, technological change being a prime example. In contrast rate regulation, which is usually accompanied by market entry constraints, inhibits both price and non-price competition and lowers uncertainty. In the first case (standards regulation) technologies that do or do not comply with the standard, once promulgated, are affected differently, but the overall rate of technological change may be reduced. In the second instance (rate regulation), the picture is more complex but limited competition and rigid price structures may also have an overall inhibiting effect on beneficial technology. In either case the ultimate question, of course, is not whether technology is hindered but what the social costs and benefits are of different regulatory forms and actions. The framework suggested provides a useful guide for addressing this issue and also helps assess possible consequences of regulatory "reform" measures.

Regulations and Technological Innovation: The Case of Environmental Chemicals. GLENN E. SCHWEITZER (Cornell University).

The technological impact of regulations can range from minor modifications in the engineering design of a single manufacturing plant to major changes in the overall approach to R&D within an industrial sector. Short term impacts, often reflected in physical changes in a specific product or process, are usually easier to discern than longer term changes in the timing and character of R&D activities, the size and composition of the technical work force, the product lines that are emphasized, and even the size and technical strengths of the firms that continue to prosper. The technological impacts of recent regulations directed to vinyl chloride and polychlorinated biphenyls illustrate the difficulty of predicting even near-term effects. The concerns of regulatory agencies over the short-term economic repercussions of regulations far overshadow their minimal efforts to understand the technological dislocations that often follow regulations on a more delayed schedule. Yet the stakes are very large. A legislatively based Commission to monitor the impact of regulations on technology innovation and annual reporting to Congress by the regulatory agencies on this topic are suggested.

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The Modeling of Social Systems: Its Uses and Limitations in Societal Problem Solving

Arranged by A. GEORGE SCHILLINGER (Polytechnic Institute of New York)

Wed., 15 Feb. / Shoreham / Board

3:00 p.m.-6:00 p.m.

Likely Utility of Formal Modes of Analysis in the Public Sector. JOHN P. CRECINE (Carnegie Mellon University)

Conditions under which formal modes of analysis and formal modeling techniques are likely to prove useful in addressing problems and policy questions in the public sector are fairly restrictive. When there is agreement on objectives, when technology affecting change is known, and when the policy levers available are under the control of, or subject to, or influenced by public decision-makers, it may be possible for the results of formal modeling and analysis to lead to desired outcomes. All too often, however, the objectives implicit in models or analysis reflect those of the analyst rather than those present in the situation, specification of relationships is not based on sound empirical evidence, and the analysis itself is undertaken for reasons other than the solution/abatement of problems. Many of the difficulties that grow into creation and application of models and analysis to public problems have their origins in the disciplinary perspective and traditions out of which such models emerge, and to the generally untested assumptions upon which most of them rested. The normal conduct of research and analysis in the social and management sciences encourages specification error, avoidance of important classes of phenomena, and diverts attention from implementation problems.

Modeling as a Vehicle for Public Policy. NATHANIEL J. MASS (Massachusetts Institute of Technology)

This paper treats the role of modeling as a guide to public policy, particularly national policy. Despite the proliferation of national economic models, problems such as inflation and recession seem today to be worsening. Increasingly economic models are not yielding solutions to pressing difficulties. Even worse, they are often addressing issues that seem detached from the real policy problems. For example, many models attempt to predict effects of policies on the "tradeoffs" between inflation and unemployment. But the real policy problem appears to be that inflation and unemployment have risen jointly in recent years, and no reliable tradeoff exists that can serve as a basis for policy. The paper attributes deficiences of economic models to two generic problems: 1) the models have insufficient depth of behavioral structure; and 2) they are too closely tied to a data base of past observations and, therefore, unable to predict "surprises" and changes in behavior mode. Finally, the paper describes a new methodology, system dynamics, that can overcome the deficiences of traditional economic models. Preliminary results are described from a system dynamics model of social and economic change in the U.S. and ways for using that model to influence public policy are discussed.

Analysis of Large-Scale Social Systems. GARRY BREWER (Yale University).

As a class of analytic techniques, models, simulations, and games have found applications across a wide variety of substantive issue areas and have been built and used by an equally diverse assortment of professionals -- representing mathematics, computer science, political science, management science, operations research, sociology, planning, ecology, economics, and so forth. Many difficult and unresolved issues and questions currently dominate the applications dimensions of the modeling business. To illustrate several of these, models of experience are drawn from the urban, military, and environmental applications areas. General and specific "lessons learned" from these experiences are noted.

Explication and Judgment in Policy Studies. ANTHONY J. WIENER (Polytechnic Institute of New York).

Policy-makers prefer to make judgments on the basis of relevant experience. Therefore they prefer intuition to analysis and incremental policy changes (staying close to what is familiar) to abrupt discontinuities in policy. All this changes,however, when they do not have relevant experience with respect to the problem at hand. Novel problems may require novel solutions, and these may require explication of the problems, analysis of the issues, and possibly even an attempt at modeling the system under consideration. Explication, analysis, and modeling of complex systems all present complex issues from the point of view of the user, some of which are well-known, while others have been less noticed. For example, there is an inherent conflict between the analyst's objective of explicating the problem for the policy-maker, on the one hand, and his objective, in the case of systems dynamics models and other models, of demonstrating "counter-intuitive" conclusions. Explication informs the intuition of the policy-maker with respect to the novel aspects of the problem, while genuinely counter-intuitive conclusions (if any) may serve primarily to confuse. One critical question must be asked of models: what, if anything, do they contribute that goes beyond the initial assumptions? The answer varies considerably from case to case. If the assumptions are consistent with the policy-makers judgments about what "makes sense," but the conclusions are not, on what basis, if any, should he be persuaded to accept the conclusions?

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OMB and OSTP in American Science Politics: What Really Happens in R & D Budgeting

Arranged by THANE GUSTAFSON (Harvard Univ.)

Thurs., 16 Feb. / Sheraton-Park / Franklin

9:00 a.m.-12:00 m.

OSTP and its Relations with OMB. PHILIP M. SMITH (Office of Science and Technology Policy, Executive Office of the President).

Policy Innovation in OMB: The Case of Agricultural Research. THOMAS P. GRUMBLY (Food and Drug Admin., Dept. of HEW).

OMB's Influence on the Development of Post Embargo Energy RD&D Policy. JACK APPLEMAN (Donovan, Hamester, & Rattien, Inc., Wash., D.C.).

Issue-Making and Issue Development in OMB: The Case of the Science, Space, and Energy Technology Division. THANE GUSTAFSON (Dept. of Govt., Harvard Univ., Cambridge, Mass.).

Obstacles to Long-Range Planning by OMB: Why Examiners Have No Time. PATRICIA EVANS PERRY (School of Medicine, Harvard Univ.).

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Energy Sources, Technological Options, and Environmental Repercussions: Spatial and Temporal Assessment

Arranged by MANOUCHER PARVIN (Fordham and Columbia Universities)

Thurs., 16 Feb. / Shoreham / Executive

9:00 a.m.-12:00 m.

Environmental Considerations in Energy Development. ALLEN V. KNEESE (University of New Mexico).

The paper briefly reviews the development of air quality policy in the United States. It then goes to the specifics of implementing state and local regulations in a particular region, the Southwestern United States. The presentation proceeds by the examination of several studies, the San Juan Basin, the Kaiparowits Plateau, and the Green River Power Corridor. In conclusion an economic alternative to the present system of emissions regulation, emissions fees, is presented.

Energy, Technology and Environment: Optimization Over Time and Space. MANOUCHER PARVIN (Fordham and Columbia Universities) and RICHARD TEPEL (Fordham University). All production and consumption processes are energy-consuming, technology-specific and have waste-residual consequences. For example, electrical power is generated by various mixtures of energy resources and energy technology, each resulting in a different magnitude and composition of environmental repercussions. The energy resource, associated technology, and specific biological, botanical and property damages are dynamically interrelated. The nature and extent of manifest or latent damages are not always known and imputation of economic costs often necessitate assessment under uncertainty. Such uncertainties relate to the problems of forecasting, and/or evaluation of consequences; the two organic ingredients of technology assessment. Government regulations appearing as incentive or deterrent affect the choice of availed options by producer and consumer alike and thus the evolution of the technology and preference structure of an economy. The purpose of this research is the analysis of some of the hypothetical consequences of such regulations on economic structure, especially those related to energy, technology, and environment.

Industrial Emissions, Health Status, and Locational Adjustment. SALVADOR R. BOZZO and LEONARD D. HAMILTON (Brook Haven National Laboratory, Uptown, N.Y.).

A Coupled LP-I/O Model for State Energy Planning
T. Owen Carroll (State University of New York, Stony Brook, New York, 11794)

State energy policy analysis and planning activities suggest construction of analytic tools describing the energy system and its impacts. A linear programming model (LP) of the energy system proves convenient to explore the allocation of energy supplies to forecasted demand under alternative future pricing and technology. However, flows in the energy system may not be consistent with the level and mix of energy forms required to support economic development in the state. An input-output model (I/O) of the economy and employment, with disaggregated energy sectors, is utilized to explore alternative economic conditions and their energy requirements. Coupled together, the LP-I/O model is a self-consistent, integrated view of energy, economic, and employment policy at the state level.

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Avoiding Social Catastrophes and Maximizing Social Opportunities: The General Systems Challenge

Arranged by RICHARD F. ERICSON (George Washington Univ.)

Thurs., 16 Feb. / Shoreham / Forum

3:00 p.m.-6:00 p.m.

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Advising the Congress on R & D: The OTA Role

Arranged by CAROLEE McBEE (Office of Technology Assessment, U. S. Congress)

Thurs., 16 Feb. / Sheraton-Park / Franklin

3:00 p.m.-6:00 p.m.

OTA as an Institutional Experiment for Congressional Policy Advice DR. JEROME B. WIESNER (President, Massachusetts Institute of Technology)

The Office of Technology Assessment, as formulated by Congress with guidance and wide support from the scientific community, was originally designed to be an organizational response to the policymaking problems posed by complex technological issues. Despite a fairly broad Congressional mandate to identify future impacts and alternative programs, OTA has, up to now, chosen to limit its involvement in controversial issues and to downplay specific policy recommendations to Congress. While such an approach to an organizational innovation like OTA might be justifiable, recent events at OTA and in Congress provide an opportunity to assess the office with an eye to the future design of its research, reports, and organizational structure.

Coupling Analytical Capabilities with Political Decisions ELLIS MOTTUR (Assistant Director, Office of Technology Assessment, U.S. Congress, Washington, D.C.)

The Office of Technology Assessment is an institutional experiment which is attempting to couple the analytical capability of the technology assessment process with the political decision processes prevalent in the Congress. This institution functions entirely within the Congress; it is not an agency of the executive branch of the Federal government. OTA works for, and reports to, the Congress alone, and while OTA has many cooperative relationships with executive agencies, the President and his subordinates have no direct control over OTA. The main coupling element to the political process for the OTA is its Congressional governing board, which consists of six Senators, six Representatives, and the OTA Director. This board sets all OTA policies, approves the annual OTA budget request, approves assessment programs, and approves the submission of OTA reports to the Congress. They also appoint the members of the advisory council. Thus, this Board plays an active role in establishing guidelines and directions for all of the OTA activities. Since the coupling af analytical capabilities with political decisions has never before been done in a systematic, continuing way, the Board's role in this process is as creative as it is challenging.

Congressional Influence On the Health of the Scientific and Technical Enterprise, DR. HARVEY BROOKS (Benjamin Peirce Professor of Technology and Public Policy, Harvard Univ.)

The relative "health" of the scientific and technical enterprise, should be a major concern of the U.S. Congress. This enterprise assures the Nation an adequate supply of young scientists and engineers; provides the knowledge base for the accomplishment of a variety of technically-oriented tasks in the National welfare; helps to keep the private sector at the "leading edge" of technological innovation and thereby insure a competitive position for the U.S. in the world market; and, provides much of the background information for basic policy decisions which can affect the whole of society. Obviously, a healthy system will perform these functions more efficiently than a malfunctioning one. The concerns of my Panel on the Health of the Scientific and Technical Enterprise are to examine the system and try to find the criteria for determining its health. We are assessing quality review mechanisms for all facets of the system; struggling with a way to determine priorities among fields of science; and looking at the roles of women, minorities and young people in the enterprise. All of these topics are vast, however, we have made some good starts. We have 'defined' the enterprise, and its components for the Congress and are working on a variety of assessments in other areas which could impact many of the science-related decisions made in the Congress. These activities are interwoven with those of the two other advisory panels, and with the entire fabric of OTA's mandate.

Applying Science and Technology to National Needs: What Can Congress Do? DR. LEWIS M. BRANSCOMB (Vice President and Chief Scientist, IBM Corporation).

Many national problems persist unnecessarily because the forces necessary to mobilize the scientific and technical skills to attack these problems have not been properly set in motion. The Congress has the power to direct the government to address the nation's technologically based needs and through legislation influence the manner and extent to which the private sector does so. Through the Technology Assessment Board, the committees of Congress invite guidance on using R&D to meet these needs. The Panel on Applications of Science and Technology is concerned with providing at least part of this guidance to the Congress. We are looking at technological innovation in the U.S. and how governments can and do affect this process, so important to the Nation's economic position. We are assessing the mechanisms which can insure that Federally funded R&D, in areas other than military and space, will be utilized by the private sector to bring the intended benefits to the public. Among the first two mechanisms we have examined are cooperative agreements and demonstrations. We are looking at technology transfer issues as they relate to developing countries in order to help the Congress in its oversight of executive branch preparations for the 1979 United Nations conference on science and technology. The application of national laboratory talents to national needs or goals is of primary concern to this Panel as well as the other two.

Congressional Decisions Concerning R&D: What Can/Does Affect Them? DR. GILBERT WHITE (Director, Institute of Behavioral Science, University of Colorado).

OTA was created because the Congress felt that they had to make many complex technical decisions without the proper background information. At the same time it was recognized that decisions directly or indirectly affecting Federal R&D policies and priorities require increasing sophistication on the part of the Congress. The Panel on Decision-Making on R & D Policies and Priorities is making some progress on providing the Congress with the tools necessary to make these decisions with a greater degree of assurance as to the probable outcome of its actions. One step is an analysis of the options that might be included in President Carter's executive branch reorganization proposal as they directly affect Federal institutions performing scientific and technical activities, and thereby indirectly affect the future performance of R&D. This information will help the Congress evaluate the reorganization proposals. Second, the Panel is looking at R&D budgeting criteria involved in zero-base budgeting and how they may be reflected in the budgets presented to Congressional Committees for action. Third, many of us are convinced that a better integration of economic and science policies is required in the authorization process. The Panel is examining energy technology policy in order to identify the points at which better correlation of economic and technological policies could occur. It is hoped that useful lessons may be drawn for other Congressional R & D decisions on the horizon.

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Investing in Intergrated Systems in Communications, Health, and Energy

Arranged by GEORGE K. CHACKO (Univ. of Southern California)

Fri., 17 Feb. / Shoreham / Board

9:00 a.m.-12:00 m.

Critical Minimum Investment in Electronic Scientific Communication. GEORGE K. CHACKO (University of Southern California).

In 1974, the cost of Scientific and Technical Information (STI) communication was estimated at $8.5 billion, representing 26.30 percent of the total R&D outlay. Even at the rather large cost, STI communication has been compared to airlifting stale bread to China. And the bread has been increasing in volume. It takes fewer and fewer years for the volume of world's STI to double, pushing to its limits the capabilities of paper-based communication to cope with the world's output of STI, and suggesting perhaps an electronic alternative. Given the current dimensions of the bottlenecks in STI flow, how much investment should be made in order to make the electronic alternative viable? If industry invests in R&D (and thereby STI) to increase sales, it is necessary to identify increases in gross sales due to improved and/or innovative products. We identify a "New" Industry whose sales could reasonably be mostly attributed to the investment in R&D (and thereby STI). An empirical answer is developed on the basis of statistical analysis of a decade of data, of the order of magnitude necessary as a critical minimum investment in the electronic alternative.

Health Technology Assessment to Select Social Alternatives. SHERRY R. ARNSTEIN (National Center for Health Services Research, DHEW).

Heart Disease, the leading cause of death in the United States, kills approximately 3/4 million people each year. Thus, there were plaudits when a team of biomedical scientists-engineers announced that they had developed a prototype for a totally implantable nuclear-powered heart. After a holistic technology assessment was conducted, however, the advent of this emerging technology was deprecated. This case study will illustrate why proposed integrated systems for health care should be subjected to comparably integrated systems of assessment to determine the soundness of the investment in terms of both their potential dollar and societal costs. In addition to describing the findings of the technology assessment of nuclear-powered heart,[1] the presentation will include a description of the state-of-the-art of the new and evolving class of policy studies known as technology assessment.

[1] U.S. Department of HEW, National Heart and Lung Institute. The Totally Implantable Artifical Heart. A Report by the Artifical Heart Assessment Panel, June 1973, 250 pp.

System Considerations for Investment in New Energy Options. PIET B. BOS (Dir., New Energy Resources Dept., Electric Power Research Institute, Palo Alto, Cal.).

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Federal Regulations: Ethical Issues and Social Research

Arranged by MURRAY L. WAX (Washington Univ.)

Fri., 17 Feb. / Sheraton-Park / Madison

9:00 a.m.-12:00 m.

Human Subjects Review Committees and Social Researchers: Practices and Prospects. BRADFORD H. GRAY, (Institute of Medicine, NAS)

Social research has been covered by general DHEW procedures and regulations for the protection of human subjects since 1966, but concern has grown in recent years about these regulations and their application by human subjects review committees at local institutions. Data will be presented from a recent study of these review committees, and problems in the application of past DHEW regulations to social research will be outlined. Finally, some implications for social research of the recent recommendations of the National Commission for the Protection of Human Subjects will be examined.

Dilemmas of Regulating Social Research. JOAN CASSELL (Princeton University), MURRAY L. WAX, (Washington University at St. Louis).

The limitation on the powers of the Congress to restrict the freedom of the press symbolized the concern of the U.S. founding fathers, not merely about journalism, but about the communication of social criticism. The 18th century philosophes had suffered from censorship and abominated it. As the republic has grown larger and more complex, the need for social inquiry has become ever more necessary, not merely for the formulation of intelligent policy, but especially for the restraint of arbitrary power. Unhappily, the judiciary and legislatures have interpreted the First Amendment to apply to newspapers and journalists, but not to academic periodicals and social researchers. Yet, as Robert E. Park understood, the latter supply "the news behind the news." The dilemmas faced by social researchers, legislators, and the courts, derive from the difficulties of protecting privacy and the integrity of the human person in the face of research inquiry.

Methods for Assuring Confidentiality: Research Records and Researcher Use of Archival Records. ROBERT F. BORUCH (Northwestern), JOSEPH S. CECIL (Northwestern).

This paper outlines the final report of our Project on Assuring the Confidentiality of Social Research Data. We consider the broad problems of assuring privacy of a respondent even in direct inquiry, protecting the confidentiality of research records against legal or illegal interrogation, and accommodating the need to make administrative records on individuals available to the researcher without breaching law or custom regarding disclosure of records. Three types of solutions to problems in each sector are discussed. Procedural approaches permit linkage of records from different archives and permit some forms of direct inquiry without jeopardizing privacy. Statistical methods, such as randomized response, permit one to obtain meaningful statistical information in face-to-face interviews without gaining deterministic information about the individual. Law-based approaches stress testimonial privilege for the social researcher.

Federal Regulations, IRB's and Qualitative Social Science: Some New Problematics in Constructing Social Inquiries. VIRGINIA OLESEN (University of California, San Francisco.)

If research is viewed as a continuing social process which begins well before the investigator enters the field and continues long after leaving, federal guidelines for the conduct of social research and the relationship of researcher to Institutional Review Boards constitute problematic relationships which shape the research. The consequence for selection of research topics, negotiation of entree, conduct of the investigation, especially in applied settings, are not well analyzed, but may be anticipated as issues in the sociology of social science with particular influence on the capacities of the qualitative social sciences to criticize the social order or to provide information on which reform is based.

Costs and Benefits of Federal Regulations. CLARK C. ABT, (Abt Associates, Cambridge, MA)

Federal regulations, with the intent of increasing the quality and efficiency of social research, have frequently stimulated and strangled it, sometimes simultaneously. Stimuli have included program evaluation requirements, competitive bidding, contract work statements with specific research questions and time and resource constraints, and privacy requirements for survey participants. Strangulations have included multi-layered clearances of survey instruments, management of basic research funding as if it were production engineering, refusal to permit state-of-the-art-improving "in-house" research as a legitimate human and intellectual capital formation expense, and treatment of social research as if it were the same as physical science research in terms of the creators' ability to internalize enough of the future benefits of research products to find a continuous stream of such efforts.
The paper describes some of the benefits and costs to social research sponsors, consumers, and producers of some of the typical major federal regulations affecting social research, and recommends reforms believed to be in the interests of both the social research community and the public interest.

17. Policy Issues

Population, Resources, Energy, and the Environment: Reports on the Debate

Arranged by DAVID L. SILLS (Social Sciences Research Council, New York, NY)

Mon., 13 Feb. / Sheraton-Park / South Assembly

9:00 a.m.-12:00 m.

The Debate Over Fertility Decline in the Third World. LEON TABAH (Population Division, UN).

The Growth-Equity Debate. DENTON E. MORRISON (Michigan State University).

The Nuclear Debate. ROBERT C. MITCHELL (Resources for the Future, Washington, D.C.).

The Environmental Debate. DAVID L. SILLS

The Leisure Debate. MEINOLF DIERKES (International Institute for Environment and Society, Berlin, Federal Republic of Germany).

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Drug Crops, Public Policy, and International Control

Arranged by JOEL M. JUTKOWITZ and KAREN KERNER (Institute for the Study of Human Issues, Philadelphia, PA)

Mon., 13 Feb. / Shoreham / Diplomat

3:00 p.m.-6:00 p.m.

The Experiment That Almost Worked: Turkish Poppy Cultivation Control. KAREN KERNER (Institute for the Study of Human Issues)

Control of illicit narcotics at the source has long been favored as a desirable alternative to strict enforcement measures. As a consequence of American efforts, Turkey became the principal participant in an experiment to test the utility of such a supply-control strategy. Turkey had been singled out by the United States government as the paramount source of illicit opiates entering the US. The full array of American diplomatic, bureaucratic and propaganda efforts--tied to the payment of foreign aid--was brought to bear on the Turkish government to ban opium production by Turkish farmers. Cultivation of poppy was banned from 1971 to 1973 in exchange for 35 million dollars to compensate the farmers and to develop new sources of income for them. With the return of an elected Turkish government in 1973, political pressures forced the ban on poppy cultivation to be lifted and the production of opium, under stringent controls, was resumed. Despite the resumption of Turkish poppy cultivation, the executive director of UNFDC has stated publicly that "Turkey has for good been eliminated as a source of illicit opium"; Mexico and Southeast Asia, according to American officials, have taken the place of Turkey in supplying the American illicit narcotics market. This paper analyzes the impact of the Turkish opium ban on Turkish agricultural patterns, rural credit, and national policies. In addition, it evaluates the Turkish experiment and its implications for international narcotics policy.

The Implications of Drug Control Policy for U.S.-Mexican Relations. JOEL M. JUTKOWITZ (Institute for the Study of Human Issues)

The opium poppy has come to be an important cash crop in Mexico as well as a significant, albeit illicit, export to the United States. The Mexican government, faced with increasing pressures from the United States, has instituted drastic measures to curb the cultivation of opium and the trade in opiates. These measures, including the use of herbicides, may create widespread ecological dangers in addition to causing economic hardships for the peasants who grow opium in otherwise marginal lands. This in turn may affect other goals of the Mexican government, including goals of economic development.

The aim of this paper is to place the conflicting policy dilemmas posed by opium agriculture into the context of the historical evolution of: 1. agriculture and agrarian policy in Mexico, 2. the Mexican Revolution's definition of economic development, and 3. the quality of U.S.-Mexico relations. While the timespan to be covered includes the last forty years, the principal focus of the paper will be events in the last decade.

The Ecological Implications of Herbicide Use. DONALD L. DAHLSTEN (University of California, Berkeley), SEAN L. SWEZEY (University of California, Berkeley).

Although there is a considerable body of knowledge on the various herbicides most of the information is at a level of resolution below that of the community or ecosystem. Nevertheless the implications of the existing data are that there are many far reaching and subtle ecological effects resulting from the selective removal of plants with chemicals. Not only is the target area disrupted but surrounding areas can be affected as well. Considerable subsequent adjustments in the land use pattern may be necessary such as the selection of crops, foraging of domestic animals, and the type of insect pest management strategy. The effects on pollinators and other beneficial organisms (particularly insects) may be important. Plant succession and diversity in agricultural and forest ecosystems are aspects that must be taken into consideration. The influence of these compounds on plant-insect relationships and interaction in soil and aquatic communities should be critically evaluated. Adverse effects on vertebrate wildlife, indirectly mediated by disruption of plant communities, may also be anticipated. Examples of ecological effects will be drawn from the literature on 2,4-D, Paraquat, and other herbicides.

Human Biology and Herbicide Use. ARTHUR W. GALSTON (Yale University, New Haven, Ct. 06520)

Herbicides developed in the last three decades have revolutionized agricultural practice in the western world, and are widely used wherever human labor is in short supply. Although a boon to rationalized, mechanized agriculture, chemical herbicides do present a significant health hazard that is frequently unappreciated. This talk will discuss several case histories that have recently been developed.

The herbicide 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) is still used in forest thinning operations in many parts of this country, despite the knowledge that all commercial 2,4,5-T preparations contain some dioxins, generally in the range of 0.1 to 1.0 ppm or higher. TCDD (2,3,7,8-tetrachloro-p-dibenzodioxin) has recently been found to be carcinogenic to non-human primates when fed at levels as low as 5 parts per trillion. It is also known to be teratogenic and to interfere with mitosis at somewhat higher concentrations, and probably causes ecological problems when used massively, as in Vietnam.

Atrazine, a major herbicide in corn fields, has been shown to be metabolized in the plant to substances that cause mutations both in the plant and in test strains of yeast. While its danger to the human population has not yet been assessed, its use in agriculture continues unabated. Similar situations are known to arise from the use of other herbicides.

The problems involved in formulating appropriate procedures to deal with these problems will be discussed.

Opium Ecology and Opium Policy in Southeast Asia. DAVID A. FEINGOLD (Institute for the Study of Human Issues)

This paper investigates the political ecology of opium production, trade and use in highland Southeast Asia. "Political ecology" is defined as the study of the interaction between systems of power and influence relations and environmental systems. Opium is the medium through which the political economies of the upland regions of Thailand, Burma and Laos articulate with national and worldwide economic systems. Among the crops grown by hill peoples, only opium has a significant international demand. The Shan States of Burma produce approximately four hundred metric tons of opium per year, making them the largest source of illicit opium in the world. Thailand produces about 70 tons, Laos 80-100. Although the crop is subject to considerable variation, a reasonable estimate is that the three countries produce about 60% of the world's illicit opium supply. The importance of opium in the socio-economic structure of the hill regions can hardly be overstressed. In addition to its pre-eminent position as a cash crop, it plays another related, but more significant role--that of a trans-ethnic, trans-national, inflation-resistant, consumable currency. A theory of "consumable currencies" is presented in the context of analyzing historical patterns of opium production, and the significance of liquidity functions for traditional economies is explored. The threat of current international narcotics policies to the survival of minority peoples in Burma and Thailand will be explored.

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US-USSR Exchanges in Science and Technology: Working with Soviet Scientists

Arranged by EGON E. LOEBNER (Hewlett-Packard Laboratories, Palo Alto, CA)

Mon., 13 Feb. / Sheraton-Park / South Assembly

3:00 p.m.-6:00 p.m.

The Problems of Technology Transfer. JOSEPH S. NYE (Dep. to Undersecy. for Security Assistance, Science and Technology., U.S. Department of State).

Joint Effort to Limit the Size of Myocardial Infarction. JAMES E. MULLER, PETER R. MAROKO and EUGENE BRAUNWALD (Dept. of Med., Peter Bent Brigham Hosp. and Harvard Med. Sch.).

A study which required early access to large numbers of patients with acute myocardial infarction was completed one year earlier because of US-USSR cooperation. In 1973 experiments and preliminary clinical data indicated that hyaluronidase (h.) may limit the size of a myocardial infarcation. Because of a slow rate of accession of patients in a clinical trial in the US, a three-month project was conducted during 1975 in Moscow. The excellent Moscow ambulance system and the network of five hospitals, which was created by the central administration of the Ministry of Health, combined to establish very advantageous conditions for the study. The participation of Soviet physicians and nurses was extremely good in spite of the damanding technical aspects of the research. A decrease in voltage of the R-wave of the ECG from hospital admission to one week later served as index of death of myocardium. Patients in the control group (N=45) lost 70.9 ±3.6% of their R-wave voltage, while those who received h. (N=46) lost 54.2 ±5.0% ($P < 0.01$). The Moscow project has lead to a larger study of h., which is now in progress.

Complementary R&D in Magnetohydrodynamics. WILLIAM D. JACKSON (Dir., MHD Div., ERDA).

The application of the principle of magnetohydrodynamics (MHD) to the generation of electricity from a flowing electrically conducting gas or plasma is dealt with in this paper. The feasibility of MHD electrical power generation was demonstrated in a number of countries during the period 1959-1961 and parallel system studies established that the open cycle system, fired with fossil fuels, showed the greatest promise for application to commercial power generation. The paper discusses requirements for the successful development of MHD power generation. It traces the evolution of the necessary R&D in the United States and the USSR. The basis for mutually useful cooperation between the two countries is explained and the results already obtained through joint projects are summarized.

Joint Earthquake Hazard Research at the Seismological Expedition in Garm, Tadzhikistan. BRIAN E. TUCKER (Res. Assoc., Dept. of Earth and Planetary Sciences, MIT)

This paper will describe the Soviet-American earthquake hazard research at the "Complex [Interdisciplinary] Seismological Expedition" of the Institute of Physics of the Earth (Academy of Sciences of the USSR). This expedition, located in a tectonically active region near the Chinese and Afghan borders has been a center of Soviet seismological, geological and geodetical research for more than 20 years and recently received wide recognition for pioneering work on earthquake prediction. The observations in this paper are based on the experiences of the author during his 3 six-month visits to this expedition.

Some comments will be made on the scope and organization of the Soviet research at the expedition including funding and the degree of centralized planning and direction of individual research projects. Comparisons will be made between some aspects of the Soviet and American seismological research observed by the author including theory development, data analysis, field work and presentation of results in papers and seminars.

A View from United States Embassy, Moscow. EGON E. LOEBNER (Former Counselor for Scientific and Technical Affairs, US Embassy, Moscow; Hewlett-Packard Labs, Palo Alto, Cal.)

This paper attempts an overview of a two-year portion of US-USSR exchange activities within 10 specialized agreements on cooperation in a variety of fields of science and technology. It will describe the nature of the complex tree structure of programs, projects, tasks, subtasks and assignments into which the US and USSR participating institutions and individual scientists have been organized. The size and pertinent attributes of this two-government supervised exchange interface will be discussed. The administrative and situational causes of several categories of difficulties and limitations, which have significantly short-changed expectations on both sides, will be analyzed. An attempt will be made to subclassify the problem areas into those which are generic and relate more or less to all international S&T cooperation and those which are indicative of specific US-USSR differences in the political, ideological and economic spheres. Conclusions drawn could aid crystallization of policy issues on formulation of International Science and Technology Programs as well as implementation of S&T exchanges with the Soviet Union.

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Solar System Exploration: Should It Be a National Commitment?

Arranged by DANIEL H. HERMAN (NASA, Washington, DC)

Tues., 14 Feb. / Sheraton-Park / South Cotillion

9:00 a.m.-12:00 m.

The U.S. Space Program--Where Do We Go from Here? EDWARD P. BOLAND (Subcommittee on HUD-Independent Agencies, U.S. House of Representatives).

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International Trends in Applying Science and Technology: Problems, Opportunities, and Policies

Arranged by RODNEY W. NICHOLS (Rockefeller University)

Tues., 14 Feb. / Sheraton-Park / South Assembly

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Historical Highlights of Science and Technology in American Diplomacy. FRANKLIN HUDDLE (Library of Congress).

Priorities in Present Policy. LUCY BENSON (Department of State).

Trends in the Industrial Sector. CHARLES DENNISON (Former Vice President, International Minerals; Member NAS, BOSTID).

Trends in Views of Organized Labor. ELIZABETH JAGER (AFL-CIO).

Trends in Scientific Community. WALTER ORR ROBERTS (Aspen Institute).

Planning for U.N. Conference in 1979. JOÃO FRANCK DA COSTA (U.N. Conference on Science and Technology for Development).

Technology and the Multinationals. RAYMOND VERNON (Center for International Affairs, Harvard University).

Views from Kenya. JOSEPH MUNGAI (Kenyan Mission to the U.N.).

Views from Algeria. ALI KHAMIS (Algerian Mission to the U.N.).

U.S. Preparations for U.N. Conference. JEAN WILKOWSKI (U.N. Conference on Science and Technology for Development).

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Neighborhoods, Cities, and Regions: The Future Governing of Urban Spaces

Arranged by MICHAEL N. ALBANES (American Institute of Architecture Research Corp., Washington, DC) and ROBERT WARREN (Univ. of Delaware)

Wed., 15 Feb., / Shoreham / Tudor

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

The Boundaries of Urban Government. LOUIS F. WESCHLER (University of Southern California), ROBERT WARREN (University of Delaware)

The formal boundaries of cities and the cognitive or mental boundaries citizens and officials have of their local governments are increasingly divergent from the scale of physical, economic, social and political systems which significantly affect local affairs. This mismatch among boundaries puts cities in a double bind governmentally. The failure of persons to accurately perceive the spatial boundaries of externally generated events and transactions affecting them seriously reduces the range of policy alternatives available and their potential success. Further, there has been a peeling off from cities of resources and formal control relating to many things critical to urban viability, such as environmental quality, health facilities, education and transportation.

A more adequate understanding of what can and cannot be governed satisfactorily at the local level is needed and requires an analytic approach which specifies and compares: the boundaries of what a community has formal and informal control over; the actual boundaries of events, transactions and actors which significantly affect the locality; and the cognitive boundaries persons in the community have of the internal and external space relevant to local governance. This framework allows the identification of constraints on community governance that relate to its multiple and changing boundary conditions and determination and evaluation of whether they can be reduced and how.

Media Scale and Community Boundaries. BEN H. BAGDIKIAN (University of California, Berkeley).

Development of a sense of community and the ability to sustain informed local self-government depend in important ways on local mass media. This is especially true in the United States where, uniquely, many central functions like education and land use are left to local governance. Since the advent of monopoly and monopoly-like local media, and their dependance on advertising for most of their revenues, there has been a radical change in the patterns of desired distribution and in the content of the reportage of these news media. Increasingly, newspapers and broadcast stations design their geographical coverage and editorial content to fit high-density, middle-class, affluent areas of interest to major retail establishments. They are abandoning circulation and content that apply to communities that do not meet these criteria, even though these communities may lie within their monopoly circulation or licensed broadcast areas. Consequently there is a widening gap between the areas of systematic and useful information distribution by the media in control of wide-area news and the areas in which a substantial portion of the American population lives and tries to create effective community institutions.

Cognitive Dimensions of Space and Boundary in Urban Areas. ROGER M. DOWNS (The Pennsylvania State University). Boundaries express spatial limits of control and responsibility. At the most basic level, boundaries include a within and exclude a without, partitioning both space and society. The multitude of urban boundaries are an uncomfortable mixture of the spatial partitions generated by two fundamentally different processes. A community of interaction generates a cohesive lived-in or experienced space: neighborhood, territory, and turf are common expressions of this idea. A community of interest generates a diffuse imposed or constructed space: most, if not all municipal governing units are of this form. With increasing settlement size and social complexity, the spatial overlap between these two types of space decreases, the control exercised by the community of interest increases at the expense of the community of interaction, and the potential for misunderstanding and conflict is magnified. Working from a cognitive perspective, this paper explores three issues: (1) the cognitive processes by which spaces are identified, labelled, and bounded, and by which a sense of place is established and preserved; (2) the potential for misunderstanding and conflict that stems from the juxtaposition of within and without viewpoints of lived-in and imposed spaces; and (3) the extension of this cognitive perspective to policy questions of control and responsibility at national and regional levels.

Matrix of Community Design GREGG EDWARDS (National Science Foundation)
Starting from resource shortages, new information technologies, heightened public expectations and activism, what are prospects for reconstituting our cities and institutions? Lacking diverse self-help initiatives and to use city social and physical structures to promote evolutionary development of better solutions--view city structures less as a static substrate and more as an external memory for community learning, a changing matrix of exploratory design. U.S cities are like underdeveloped countries (UDC) when their needs are confronted with obvious resources; this paper reviews the numbers and concludes that, as with the UDCs, the problems are largely institutional and cultural. Then, what are the major policy alternatives, and the resultant cityscapes? At one extreme, neighborhoods might choose their own territory as the dissatisfied leave. By examining the major functions and interests to be served, the basic dimensions are sketched for city as a cultural biome, and for the coevolving policy ecology.

Self-Help Housing -- Structuring the Process
IAN DONALD TERNER (University of California at Berkeley)

A vigorous self-help housing movement is flourishing in the least likely of all American settings -- New York City. It started as an unstructured, illegal squatters' movement at the height of the displacement and demolition attending New York's urban renewal program. Now, a dozen years later, the City is host to a growing self-help movement which has been transforming the wreckage of abandoned building shells into decent and safe low-cost homes. The rationale behind New York's homesteading movement is straight-forward: there are some 200,000 abandoned dwellings in more than 10,000 buildings currently lying vacant and wasted -- virtually enough housing to accomodate every resident of entire cities the size of Boston, Washington, or San Francisco. There are also hundreds of thousands of able-bodied New Yorkers, anxious to work, and chronically unable to find jobs. The object of the homestead effort is to link these two problems in a positive and constructive way: to view the buildings as potential new homes for the people, and to view the people as the potential restorers of the buildings. The challenge has been to avoid smothering a basically spontaneous grass roots process with an arbitrary structure and layers of bureaucracy. The approach to doing so has been deliberately passive and non-programatic, but provides an abundance of independent technical assistance. The New York model is generalized, and conclusions are drawn for other settings.

Energy and Information: Building New Infrastructures. JOHN P. EBERHARD (President, AIA/Research Corp., Washington, D.C.).

Community Based Energy Conservation Strategies. WOODY RAINEY (Principal, COMMONS, New York, N.Y.).

Localizing Continuous Transformations. DON SCHON (Prof. of Urban Studies, MIT).

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Domestic and International Scientific Aspects of Extended Marine Jurisdiction

Arranged by BRIAN J. ROTHSCHILD (NOAA)

Wed., 15 Feb. / Sheraton-Park / South Assembly

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Extending Marine Jurisdiction BRIAN J. ROTHSCHILD (Department of Commerce)

In recent years a number of countries have extended their marine jurisdiction. The U.S., for example, recently enacted the Fisheries Conservation and Management Act of 1976 which gives the U.S. authority to manage stocks of fish within its conservation zone, 200 miles from the coast line. The extensions of jurisdiction imply that the coastal states have new responsibilities for managing the resources under their jurisdiction. These new responsibilities for management have placed new and different requirements on marine scientists. This session will concentrate on the extended jurisdiction aspects of fishery science. It will cover--in the context of fishery extended jurisdiction--scientific challenges; the policy aspect of marine science; new problems before scientists; information requirements; multinational apsects of marine science; the role of the social scientist; the coastal zone and marine science; and forensic aspects of fishery management.

Impact of Extended Jurisdiction of Fishery Science and Scientists DAYTON L. ALVERSON (N.W. Alaska Fisheries Center)

Marine Science in the Gulf and Caribbean Under Extended Jurisdiction. HARVEY R. BULLIS, JR., (National Marine Fisheries Service)

The marine waters of the Gulf and Caribbean Region present the most intricate mozaic of political jurisdictions for any area of its size on Earth. By defining the Region as Continental to the westward and along a line 200 miles seaward of all land masses from the Amazon River at South end to Cape Hatteras at the North end approximately 95 percent of the sea surface area would fall within a range of 200 miles from some point of land. Depending upon definition, approximately 30 political entities, ranging from nations to territories to possessions, exert jurisdictional responsibilities. In 1968, under the joint sponsorship of UNESCO, FAO, and WMO, a symposium was held in Curacao (Netherlands Antilles) with the objective to improve scientific cooperation on the marine resources of the Region. The resulting program became known as the Cooperative Investigations of the Caribbean and Adjacent Regions (CICAR). CICAR was continued through 1975 and summarized at another symposium in Caracas in mid-1976. The IOC was requested to sponsor a new program for the Region. Delegates to the inaugural meeting, which was held at the immediate conclusion of the final CICAR Symposium, selected the name IOCARIBE to designate this effort. During this meeting, the IOCARIBE delegates considered a large selection of programs that might be identified as the focus for continued international scientific cooperation. This paper will attempt to evalute the IOCARIBE program as developed under the new constraints of Extended Jurisdiction in comparison to the approach and results of CICAR.

Social Science and Extended Jurisdiction. EDWARD MILES (University of Washington).

This paper approaches the implications of extended marine jurisdiction in terms of an interrelated set of problems. The major potential social science contributions can be made on four of these problems: a) the determination of "optimum yield" in the management of fisheries; b) the determination of "net benefit" relative to multiple uses of the economic zone; c) the distributive and redistributive aspects of bargaining over resource allocation between adjacent states, and d) the problem of technical assistance to developing countries management and utilization.

Extended Jurisdiction and the Coastal Zone. ROBERT W. KNECHT (Office of Coastal Zone Management, NOAA)

This paper explores the relationships between the extended jurisdiction fisheries program and the coastal zones of the Nation. Through their coastal zone management programs, coastal states are setting in place policies governing the use and protection of their coastal lands and waters. These policies, under most circumstances, will also apply to Federal activities which could impact these lands and water resources. Hence, a potentially important link is created between the Federally sanctioned fishery management programs in the 300 to 200 mile region and those of the states in the territorial sea.

Problems of Scientists Under Extended Jurisdiction ROBERT L. EDWARDS (Northeast Fisheries Center)

Extended jurisdiction has thrust scientists directly into domestic fishery allocations problems, with all the suddenness and discomfort of an earthquake. They now find themselves in a different and as yet poorly defined role in terms of their relationship to society as well as the fishing industry. Previously, in various international fishery commissions there was a priori general objectives that guided the decision process. Now the situation is often reversed and the scientific work often precedes the development of objectives - in the present case the development of the criteria for and the statement of the optimum yield.

Information Requirements of Extended Jurisdiction IZADORE BARRETT (Dept. of Commerce NOAA)

The FCMA of 1976 requires management of fisheries within the U.S. 200-mile zone so as to produce optimum yield, a concept encompassing biological, economic, and sociological considerations. Managers are enjoined under the Act to establish the optimum yield of a fishery on the basis of the best information available. These information requirements of extended jurisdiction raise issues of data content and quality; methodology of data collection; mechanisms of data management; identification of user groups; confidentiality; levels of access to the data; and jurisdiction, among others. These issues, and actions being taken by the National Marine Fisheries Service to deal with them are examined and discussed.

Forensic Aspects of Extended Jurisdiction WILLIAM C. BREWER, JR. (Dept. of Commerce, NOAA)

Management of the resource includes habitat protection; allocation of harvest; development of industry; and enforcement. Of these elements, allocation of harvest is the most difficult, and requires an institutional structure which will blend scientific knowledge with economic and social imperatives, and a body of jurisprudence which interprets general legal principles in terms that can readily incorporate the rapidly changing body of scientific concepts and information applicable to fisheries management. Regional fishery management councils are a promising but untested way of meeting the first requirement. Only cooperation of government attorneys and scientists, coupled with informed judicial interpretations, will meet the second.

Ocean Policy JAMES W. CURLIN (Department of Commerce

United States ocean policy is currently undergoing review within the Government. Eight years have passed since the issuance of the Stratton Commission report "Our Nation and the Sea". During the interim, significant developments have taken place both with regard to the significance of the ocean in terms of domestic and international politics, and to Federal programs designed to utilize and protect the resources of the sea. Congress has taken the lead in enacting several important laws which establish a framework for managing the Nation's ocean and coastal resources. In the absence of a concerted interest in the ocean by past administrations, the implementation of these laws has been spotty and lack of coordination and fragmentation of the jurisdiction have made the administration of the ocean-related statutes difficult. One of the major issues confronting the wise use of our coastal regions--both onshore and offshore--is the expanding use of the resources and space around the coastal margins. New management approaches are needed to resolve conflicts among competing uses and to provide sufficient planning and allocation of the natural resources while preserving future options and protecting the marine environment. Ocean resources, unlike land-based resources which are largely in private ownership, are common-property resources and are therefore held in trust for the people by the State and Federal Governments. Therefore, government must devise a multiple-use management of the coastal region.

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Creative Tensions: Federal Energy Policies versus State Energy Policies

Arranged by FRANK M. GRAVES (Institute of Public Administration, Washington, DC) and JON M. VEIGEL (California State Energy Commission, Sacramento, CA)

Thurs., 16 Feb. / Sheraton-Park / South Assembly

9:00 a.m.-12:00 m. and 3:00 p.m.-6:00 p.m.

Responsibilities of the New U.S. Department of Energy.

ALVIN ALM (U.S. Dept. of Energy, Washington, D.C.)

The Department of Energy Organization Act transferred from the U.S. Department of the Interior to the Department of Energy certain responsibilities for regulating the economic terms and conditions of leasing energy resources on Federal lands. These include fostering competition, implementation of alternative bidding systems, establishment of diligence requirements, setting production rates, and specifying procedures, terms and conditions for the acquisition and disposition of Federal royalty interests taken in kind. The presentation discusses how the new Department is moving to exercise its responsibilites, and how it relates to the Interior Department, in the context of new legislation governing Federal leases and in the context of broader national energy policy concerns.

Energy Policy from a Consuming State Perspective.

RICHARD L. MAULLIN (California State Energy Commission, 1111 Howe Avenue, Sacramento, CA 95825).

California must have new supplies of natural gas in the early 1980s. Under certain "worst case" assumptions about the future, these new supplies may be needed just to serve homes, schools, hospitals and other high-priority consumers. Failure to obtain additional natural gas will result in more air pollution and may result in lost production, lost jobs, and higher prices. The state's energy analysts have evaluated the potential availability of natural gas from various new sources in the early 1980s and concluded that liquefied natural gas (LNG), is a necessary energy insurance policy. As with any insurance policy, risk judgments have to be made. These judgments are difficult when examining gas supply questions because prices, new gas discoveries, the development of natural gas substitutes and timing are very unpredictable. Unfortunately, there is little room for this kind of uncertainty on the consumer's end of the gas supply system. Investment decisions, jobs, food production and home heating requirements rely on its supply. Many consumers, in fact, have no realistic alternatives except perhaps at great cost and far in the future. California energy policies are driven by this natural gas situation and by the availability of Alaskan oil. Policy responses put in place by the state have ranged from extensive conservation programs and regulations, to the detailed examination of power plant siting requests to the aggressive development of alternative technologies.

Full Scope of Federal Hydrocarbon Land Leasing Process.

GEORGE L. TURCOTT (Bureau of Land Management).

Lacking an as yet clearly defined national energy policy, Federal hydrocarbon land leasing is subject to diverse subpolicies. Statutes include Federal Land Policy and Management Act, National Environmental Policy Act, Minerals Leasing Act, Coastal Zone Management Act. Within Interior BLM, USGS, FWS, NPA, BIA are involved. Interdepartmental involvements include Interior, DOE and agencies it has absorbed, ICC, DOC, and USDA's FS. Varied interest include Developmentalists vs. Conservationists, and National vs. Regional/State/local interests. Within this structure, the role of BLM is to execute, not decide national policy. BLM mission is multiple use management of all land resources, but finite nature of hydrocarbons complicates this. BLM-administered lands include public lands, acquired lands, and OCS (Outer Cont. Shelf). Other lands in which BLM has a leasing responsibility include FS and NPS, Indian and private lands with mineral estate reserved to U.S. International issues which complicate BLM leasing program include OPEC policies and U.S. balance-of-payments. Also, national economic and social policies committed to coal as an alternative to oil and gas. Departmental policy is timely development, and receiving fair market value for public. Present and proposed new leasing procedure is outlined as operative under DOE. BLM's land use planning system with information gathering components and public participation under multiple use is examined. Lease sale procedures are described.

States' Rights and Role in Energy Development.

JAMES MONAHAN (Special Asst. to the Governor, State Capitol, Denver, Colorado 80203)

Efforts by Federal officials to identify and influence obstacles to the acceleration of domestic energy production have failed to acknowledge two significant issues. First, areas near energy development projects are suffering severe social and economic impacts. Rapid growth burdens community services and jeopardizes the local government's fiscal integrity, causing hostility toward energy development and reduced worker productivity. Secondly, the Federal government's sponsorship of programs designed to increase energy supplies carries the potential for Federal pre-emption of traditional State oversight of facility siting and environmental standards. These secondary, community-related impacts can be mitigated only if they are analyzed as part of the primary Federal energy development decision. Prior to initiation of a project, all levels of government could negotiate degree and extent of their assistance. State government's role ideally would be regulatory: protecting health, welfare and safety, and directing the pace and location of energy development. Such a cooperative management approach would minimize the "eleventh-hour" role that State government must sometimes exercise in blocking certain development proposals.

Analysis of Energy Conservation Programs.

JOHN P. MILLHONE (Minnesota Energy Agency, 150 E. Kellogg, St. Paul, Minn. 55101)

Energy conservation is a broad, vague, high-minded issue. Virtually everyone is for it; this is both its strength and its weakness. Conservation measures often are approved with little controversy, yet support is shallow. When opposed by an entrenched special-interest group, conservation measures may not be approved. When this occurs, it is because our thinking about conservation remains fuzzy and undisciplined. We have not given conservation the hard, analytical thought necessary to establish it as a high-priority public policy objective. The paper represents an initial attempt to provide a stronger analytical basis for energy conservation programs.

Alternative Energy Supply Technologies.

JON M. VEIGEL (California State Energy Commission, 1111 Howe Avenue, Sacramento, CA 95825.)

The energy technologies that are "alternative" today will have come of age when they become tomorrow's conventional technologies. California is the first state to implement programs with the goal of making alternatives commonplace. Success will be measured by the impact alternative technologies have in displacing energy or capacity now provided by gas, oil, or nuclear energy and by the speed with which such impact becomes significant. The effective utilization of new energy sources depends on their integration into the energy-related infrastructure already in existence - from manufacturer to installer to ultimate user. Social acceptance of new energy systems will be facilitated the smaller the changes that are required in societal patterns of operation, behavior, etc. and the more natural the transition from the "old" way to the "new" way. California is aggressively promoting the immediate or near-term use of practical alternative systems such as active and direct solar, wind, biomass, electric and non-electric geothermal, and fuel cells. The state has adopted near-term goals for each system and designed specific actions to meet those goals. The state formulates and implements policies and programs that regulate, offer incentives, give training and information, etc..

The ERDA Program on Alternative Energy Supply Technology

JAMES S. KANE (Office of Energy Research, U.S. Department of Energy).

The ERDA program on alternative energy supply technology is a national program; it cannot be expected to cover adequately all the subjects and to meet the diverse and specialized requirements that must be considered at the state and local levels. It is not surprising that tensions should exist.

The national program will be described, with special emphasis on those aspects of the program which can be expected to lead to interactions with other jurisdictions. The alternative supply technologies are considered to be coal gasification, liquefaction and some methods of direct combustion, recovery of fuels from oil shale, all forms of solar energy, geothermal energy, fusion energy, and both thorium and uranium breeders.

*This abstract was prepared prior to the formation of the Department of Energy, to which all the activities described were transferred on October 1, 1977.

The ERDA Program of Energy Conservation Development. SAVITZ, MAXINE L. (ERDA, 20 Mass. Av., N.W., Washington, D.C. 20545)

The energy conservation development programs in ERDA encompass research, development and demonstration to lead to more efficient use of energy in buildings, industry and transportation. Some examples are annual-cycle energy systems for buildings, development of advanced heat engines for automobiles, and waste heat recovery techniques for industrial processes. Dissemination and implementation methods that are being used or tested will be discussed. A special new program in small-scale energy technology is now underway in pilot form on the West Coast, to be followed by another in New England. These will be described.

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Problems and Progress in Scientific and Technical Advising for Policy Formulation at the State Level

Arranged by ROBERT W. HANSON (Univ. of Northern Iowa, Cedar Falls)

Fri., 17 Feb. / Sheraton-Park / South Assembly

9:00 a.m.-12:00 m.

Strengthening Scientific and Technical Capacity in State Government. EDWARD L. HELMINSKI (National Governors' Association).

The extent to which the states must deal with technologically related issues and therefore have access to appropriate resources is readily evident. In addition to being delegated the responsibility to implement federally enacted legislation regarding environmental regulations, public safety and energy conservation, the states are being pressed by their citizens to establish comprehensive programs in such areas as strip mining, land reclamation, land management, energy resource development and regulation and a myriad of other areas having sizable S/T components. Several Governors and state legislatures have recognized the need to develop a capacity to more effectively develop and implement policies and programs in S/T related areas. Over a dozen state legislatures have established S/T staff units within existing legislative research agencies. Most all Governors have at some time designated a state science advisor. For the most part, these advisors served on a voluntary basis, holding positions at prominent state universities or in private industry. In a few states, scientific expertise has been integrated on a full-time basis into the executive branch. The National Science Foundation has played a major role in stimulating these developments. In 1976 Congress established the SSET program to provide $50,000 to each state to develop plans to integrate S/T resources in state government. The program, just recently implemented, has attracted over 21 states in the first round of awards.

Utilizing Regional Resources for R & D in Site-Specific Disciplines Related to Energy Development in the Rocky Mountain States. E. GERALD MEYER (University of Wyoming)

The Rocky Mountain region is the nation's "energy basket." It not only has a large fraction of available non-renewable resources (uranium, coal, oil, gas, shale oil), but an abundance of renewable resources (solar, wind, biomass). The use of these resources is crucial to solution of the nation's energy problem. However, development will have to occur with due regard to regional interests, principally maintenance of environmental quality and assurance of economic benefits. To accomplish this objective there is a need for base-line data, operational information, and sophisticated modeling. Since the disciplines involved are predominantly in the social and biological sciences the work is highly site-specific. Thus it is the state universities and the state agencies that must cooperatively do the necessary R & D. With extensive modern facilities and highly competent faculties and staffs, the regional institutions are fully competent to successfully do the job. Moreover, the individuals not only have the necessary regional experience, but must live and their children must live with the results.

Science and Technology Advising: The Michigan Experience. WILLIAM C. TAYLOR (Michigan State University)

The present Science and Technology mechanism in Michigan has evolved from several experiments with alternative structures for bringing science advice into the Executive Office. With support from N.S.F., the State has contracted for the services of a University faculty member to serve as Science Advisor and as a member of the Governor's Cabinet. This integration of the role of Science Advisor with other key positions on the Governor's staff provides the opportunity to bring technical input to bear on a broad range of topics.
The operating mechanism includes a Science and Technology Commission and the use of ad-hoc committees for specific projects. Recent activities include Project SEAFARER (a Navy communication system utilizing ELF waves); Nuclear Waste Disposal and the PBB contamination of Michigan cattle. The advantages of the Michigan mechanism as used in these activities, and the problems encountered in dealing with these issues are described.

The Maryland Experience. HARRY KRIEMELMEYER (University of Maryland).

The experience gained in this state over a period of several years will be presented from the viewpoint of an advisory council that has been in existence for several years. Problems and successes will be reviewed.

The Louisiana Experience. WILLIAM B. DE VILLE (Office of Science, Technology and Environmental Policy, Office of the Governor, State of Louisiana).

Description of organizational structure of the Office of Science, Technology and Environmental Policy within the Governor's Office in Louisiana, linkages with the Federal structure, state agencies, local government, universities, and the private sector, and illustrations of tasks completed or in progress. Observations on the need for analysis of the purposes and roles of institutionalized scientific and technical capabilities in the Governor's Office.

Colorado Government Scientific and Technical Advising: Experiences and Factors Affecting Progress. FLOYD C. MANN (University of Colorado at Denver).

There have been several major attempts since the beginning of the 70's to develop and strengthen the institutional mechanisms for linking science and technology information needs of State government to the knowledge and research resources in Colorado. These will be described briefly along with the principal problems encountered. Factors within State Government and within the State's research institutions that facilitate or hinder the linking of problems and knowledge in policy formulation and decision making will be identified and discussed.

The Iowa Experience. ROBERT W. HANSON (University of Northern Iowa).

The present S/T advisory mechanism in Iowa is limited to the executive branch and consists of an advisory council of three 4-member panels dealing with Energy, Environment, and Resources. Ad hoc committees outside the council are included in the mechanism for specific studies. The manner in which the council was formed and a review of its attempts to develop an effective mechanism for bringing S/T advice into policy formulation will be presented.

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Some Views from Inside Congress on Water, Pollution, Biohazards, and Nutrition

Arranged by RICHARD A. SCRIBNER (AAAS)

Fri., 17 Feb. / Sheraton-Park / South Assembly

3:00 p.m.-6:00 p.m.

Water: The "Energy and Natural Resources" Problem of the 1980's. YACOV Y. HAIMES (Cong. Science Fellow, Com. on Science and Technology, U.S. House of Rep.)

Water is an essential resource for almost all phases of energy development including mining, reclamation of lands, on-site processing, transportation, refining, gasification, liquefaction, and all other conversions of fuel to other forms of energy. An appreciable diversion of water from present uses to meet new energy needs will take place in the 1980's. Consequently, a national water policy, which is responsive to both national and regional goals, is urgently needed.

Some of the major policy issues discussed in this paper include: improving irrigation efficiency, protection of ground water, land use and management, Indian water rights, etc. Trade-offs should be analyzed with respect to time (long-, intermediate-, and short-term), goals (national, regional, and local), the economy (the various sectors), and the environment (quality of life and the ecology).

CO_2: Short- and Long-term Implications of a "Doomsday Problem". THOMAS MOSS (Staff Dir., Office of the Hon. George E. Brown, Jr., U.S. House of Representatives), HAVEN WHITESIDE (Professional Staff Member, Com. on Environ. and Public Works, U.S. Senate).

The "CO_2 problem" - that of possible global climate change induced by the CO_2 residue of human fossil fuel consumption and other practices - is perhaps the most interesting example of current doomsday issues. It presents unprecedented challenges in both the scientific and political arenas. In the technical area, it will require a massive world-wide experiment to be conducted with a reliability and organization never yet equaled, if it is to have sufficient impact to catalyze the social-economic changes which could be necessary. Politically, it will require persuasion of remarkable strength to move institutions along costly pathways, where no immediate and direct reward is evident. The short range problem will be to lay the groundwork for both the technical program and for understanding of its social-economic implications. The long-range problem will be to pull the entire technical-political effort together in a world-wide action which could be crucial to future generations.

Biohazard Control Legislation: Issues of Public Safety and Scientific Freedom. R. DARRYL BANKS (Professional Staff, R&D Planning and Priorities Prog., Office of Technol. Assessment)

Biohazard Control Legislation: Issues of Public Safety and Scientific Freedom. GEORGE JACOBSON (Professional Staff, Com. on Environ. and Public Works, U.S. Senate)

Recent advances in the field of DNA research led to concern on the part of scientists about possible health hazards arising from certain experiments. Over a period of several years the issue came to be more widely known to the general public and to politicians, and in 1977 several bills to regulate DNA recombination experiments were considered by the US Congress. After serious efforts to develop comprehensive legislation the Congress failed to act, at least partly because of intense lobbying by interested scientists. The history of the DNA legislation raises the question of the ultimate ability of Congress to deal with issues technical in nature, and of the possible need for a permanent structure to deal with similar issues in the future.

Pressing National Nutrition Issues. KRISTEN W. McNUTT (Cong. Science Fellow, Com. on Agriculture, Nutrition, and Forestry, U.S. Senate)

Nutrition is gaining attention as a national priority because so often it is intricately related to other pressing issues and/or social changes. These include (1) the energy issue (the energy cost of food production, processing and delivery; decreased availability of food to malnourished populations; and international aid needs for fuel versus food), (2) emphasis upon disease prevention and individual responsibility for health, (3) growth of consumerism and consumer input into health planning and priorities for research moneys, (4) the role of federally funded food programs under a revised welfare or "better jobs/better income" program, and (5) a growing concern for the physical and social well being of the elderly, the least well-nourished population group in the United States.

Contributed Paper Abstracts

100. Interpretation of Nonthermal Radio Spectra

MICHAEL A. GUILLEN (Physics Dept., Cornell University)

Celestial objects that emit radio radiation are very common. Furthermore, their variety has been deciphered into four distinct classes. The largest -- class S -- is comprised of objects whose flux densities diminish with increasing frequency according to a power law. Within the popular (and prudent) assumption that they are sources of synchrotron radiation, a rigorous, mathematical proof is derived that any class-S spectrum can only be due to the cumulative emission of particles whose energies are also distributed according to a power law. This has only been assumed up until now.

Evidence is presented that spectra belonging to other classes -- classes C^- and Cpx -- might be caused by synchrotron-radiating particles whose energies are distributed according to a relativistic Maxwell-Boltzman. If true, this suggests, remarkably perhaps, that the particles were initially derived from a thermal environment.

Finally, evidence is given for an intriguing, systematic characteristic of apparently all class C^- spectra.

101. Formulas for Planetary Positions and Lunar Elements.

K. F. PULKKINEN and T. C. VAN FLANDERN (U. S. Naval Observatory).

This paper discusses low precision (one arc minute) formulas for geocentric and heliocentric positions of the Sun, Moon, planets, and for the lunar elements, valid for any epoch within 300 years of present. The formulas are generated by a computerized formula manipulator which is written in FORTRAN in such a way as to be independent of the bit or word structure of any particular computer. The manipulator is a collection of subroutines which do algebraic operations on harmonic series. The user supplies a master FORTRAN program with certain parameters which describe his particular machine and problem. The master program then produces a FORTRAN deck which is a tailor-made manipulator program, which can be used to solve his problem of generating the lunar and planetary formulas, samples of which will be shown. These are expected to be useful for programming mini-computers and desk calculators, and are accurate enough for telescope pointing, planetarium setting, tidal theory, searching for conjunctions and alignments, and other applications in which definitive positions are not required. Variations in the lunar orbital elements are especially striking, showing that an ellipse is a very poor approximation to the lunar motion.

102. The Age of the Asteroid Belt.

S. J. BENSUSEN and T. C. VAN FLANDERN (U. S. Naval Observatory).

We have sought evidence to either support or reject the hypothesis that the age of the asteroid belt is not the same as for the rest of the solar system, but that it is actually closer to about 5 million years old. (See related abstract entitled, "Do Planets Explode?") Although it is not at present possible to trace back asteroid motions over several million years, because the positions of the perturbing planets are not themselves known that far back, it is marginally possible to examine the orientations of the orbit planes of asteroids with similar orbital elements, to search for a possible common intersection point of the orbital planes five million years ago. The proper elements and secular rates of change are taken from J. Williams for two large asteroid families -- Eos (78 members) and Koronis (64 members). When the orbital plane clusterings are examined at 50,000-year intervals over the last 100,000,000 years, we find no peaks which cannot be explained by chance. However, considering the known limitations on the accuracy of the calculated rates, it may be significant that both families show statistical tendencies to have orbital plane clusterings very close to the predicted epoch of five million years ago, with no clusterings of comparable strength close by. A more accurate calculation of Williams's secular rates is now being attempted, which should enable the matter to be decided definitively.

103. Thermally Induced Liquid-Liquid Phase Separation of Polymer Solutions.

Dieter Frank (Armak Company)

Polyolefins and some condensation polymers are dissolved in amines, ethoxylated amines, alcohols, ketones and esters; all non-solvents for the polymers at ambient temperatures. Upon cooling these solutions from $200^{\circ}C$ to $130^{\circ}C$ separation into two liquid phases occurred. Further cooling yielded solidification of a continuous polymer phase containing an interconnected continuous liquid phase. A uniform structure resulted of solvent-filled spherical cavities in the 1 to $30\mu m$ range with inter-connecting channels one order of magnitude smaller. This unexpected separation of the solvent phase uniformly distributed within the continuous polymer matrix is accompanied by a discontinuous portion in the melting point depression curve of the phase diagram. Constant polymer crystallization temperatures could be determined experimentally for all polymer concentrations of the discontinuity region. Based on existing experimental data this novel phase separation may be explained by either nucleation and growth as described by Papkov and Yefimova[1] or Spinodal decomposition (Cahn[2] and Smolders, van Aartsen, Steenbergen[3].)

[1] PAPKOV, S.P., S. G. YEFIMOVA, Faserf: u. Textilechn, Sowj. Beitr. 4. 118 (1967)

[2] CAHN, J.W., Acta Met. 9, 795 (1961); CAHN, J.W., J. Chem. Phys. 42. 93 (1965)

[3] SMOLDERS, C.A., J.J. van AARTSEN, A. STEENBERGEN, Kolloid-Z.u.Z. Polymere 243 14-20 (1971)

104. A New Microporous Polymer Matrix

Dr. Anthony J. Castro (Armak Company)

Described herein is a unique family of porous materials whose characteristics may be adjusted within some limits to provide a substrate for scientific study. The polymer structure consists of a uniform collection of essentially spherical cells with a high degree of interconnections. This structure is generally maintained over the range of void volume from 30-90% in polymer matrices ranging from polyolefins such as polyethylene to condensation polymers such as Nylon II. The range of cell sizes range from $30\mu m$ to less than $1\mu m$ while pore sizes range from about $10\mu m$ to less than $.05\mu m$. By controlling the parameters involved in the phase separation phenomenon such as ratio of phase proportions, nature of separating phases etc., one may bring about these variations. The system polypropylene-N-tallow diethanol amine has been studied most extensively. The following discussion relates to materials produced from that confirmation only. Void volumes in structures as previously described have been obtained from 30 to 90% by changing the ratios of polymer and non-polymer. It can be seen from mercury intrusion examination that the distribution of pore sizes is not seriously altered by shifts in absolute values. Internal surface as measured by B.E.T. methods are in the range of 85-95 sq. meters/grams which is inconsistent with a simple model of closely packed cells.

105. A Proposed Chemical Model for the Oxidative Dissolution of Metal Sulfides.

G.C. THOM and P.F. WATERS (The American University).

A detailed study[1] was conducted on the kinetics and mechanism of the heterogeneous metal sulfide-sulfur dioxide reaction in aqueous media. The study showed that the major products of this reaction are the dissolved metal ions, and thiosulfuric and sulfane sulfonic acids which subsequently decompose into elemental sulfur. Using these results and a model proposed by Forward and Mackiw[2] for the alkaline dissolution of sulfide ores, a chemical model was developed which describes the mechanism by which metal sulfides undergo oxidative dissolution in both acid and alkaline solutions. The model accounts for the nonlinear (parabolic) and mixed (linear and nonlinear) dissolution kinetics observed in acid solutions by explaining the mechanism by which elemental sulfur forms and occludes the metal sulfide surface. For alkaline dissolution, the model confirms the fact that, because all reaction products are soluble (i.e., no elemental sulfur is formed), linear dissolution kinetics are followed. The model will be useful in both the development and improvement of hydrometallurgical processes which recover metals from sulfide ores without the emission of sulfur dioxide inherent in pyrometallurgical processes.

1. G.C. Thom, Ph.D. Thesis, The American University, Wash., D.C., 1977; Diss. Abstr. Int. B, 38, 1239B (1977).
2. F. Forward and V. Mackiw, Trans. AIME, 203, 457 (1955).

106. Properties of Some Ergodynamic Systems. DAVID C. DE PACKH (Entropy Research).

A system is defined as ergodynamic if it allows a flow of energy through its boundaries but is otherwise closed. There may or may not be internal matter flow. The internal energy is stored in electromechanical or chemical modes, the former representing classical degrees of freedom and the latter degrees of freedom largely frozen at ordinary temperatures. A set of equations describing energy growth in regenerative modes with energies very large compared with thermal-equilibrium values is developed on certain restrictive assumptions. It is shown that the total stored energy tends toward a local maximum and that for an important subset of these systems the longest-lived modes are those having the least energy depletion, regardless of initial mode energies or growth constants. The analysis has been applied to a model autocatalytic chemical system and to a model electronic oscillator. In the latter case a comparison of energy growth by computer solution of the exact circuit equations and by the approximate energy-growth equations has been made. The agreement is good for small values of the growth constant.

107. The Quantum Surface Hypothesis. ROBERT J. HEASTON

The original de Broglie analysis of wave-particle duality was based upon the assumption that the Bohr orbits were an integral number of wavelengths. If an analogous line of reasoning is applied to a spinning particle, the modified de Broglie derivation leads to the following hypothesis: Every particle has a surface, designated the quantum surface, which spins constantly at the speed of light. The radius of this surface is the reduced Compton wavelength. The frequency of rotation is given by $E = hf$. The potential energy of a particle based upon the centripetal force at the quantum surface is $U = mc^2$. Translational acceleration and deceleration of a particle results in a spin compensation of one half quanta to agree with Maxwell's equations as well as relativistic effects. Calculations of strong interaction and resonance particle lifetimes are consistent with this model. Overall, the quantum surface hypothesis offers a more meaningful physical representation of wave-particle duality.

108. Atomic Stationary State Radiation? ROBERT L. WADLINGER (SCA Services, Inc.).

The Bohr-Schroedinger Hydrogen atom energy equation (non-relativistic) is analyzed in light of the accepted mechanism: $\Delta E = E_n - E_m = h\nu$. A latent stationary state radiation is surfaced. It is shown that the frequency, ν, of the radiation emitted is equal to the difference between the respective stationary state frequencies ν_n and ν_m. The wavelength of the radiation intrinsic to the states characterized by E_n is calculable to the same precision as the experimentally measured wave length of the emitted radiation.

109. Relativistic Space - Time, Elementary Particles and Nuclei. ENOS E. WITMER (University of Pennsylvania).

A thorough statistical investigation of the masses of nuclei and elementary particles has led to the following interesting and novel conclusions. If only the right units are chosen to express the masses of nuclei, the mass numbers are predominantly approximately of the form $2^{-s}T$, where T is some integer and s a relatively small integer. Here I would emphasize the special importance of the case $s=0$. The right masses to use as units are first and foremost the electron rest mass m, secondly the mass of $\pi^{\pm}$ and then the masses of all the other stable elementary particles, except the masses of p and n, but including also the masses of (136m), (37^2m), and even ψ (3100). I take $m = 548.5788504\ \mu u$. One of the striking things here is the importance of the integers 136, 36, 37, and 37^2. These integers come directly out of the relativistic concept of space-time,[1] in that space-time has 4 dimensions and space 3. Thus $136 = \frac{1}{2} \times 4^2(4^2 + 1)$ and $36 = (3!)^2$. Possibly this may be regarded as a modern version of an idea that originated with Plato. Note also that the mass of the newly discovered particle upsilon is almost exactly 136^2 in electron mass units.

1. E.E. WITMER, Phys. Rev. 42, 316, 1932.

110. The Radional Field Theory - Aritnmetical Physics. Antol J. Shneiderov (PIA, Institute of Philosophical Inquiry)

In an outline of RFT the derivation and numerical values of its constants and parameters* are presented in a table. New definitions of some physical quantities and phenomena are given, and the following topics are breifly discussed in terms of RFT: The quantum of energy in the rational field; The elem. charge e in the radional field; Quantity of matter $Q = \Sigma m$ in a body is not equal to its mass; Magnus effect, and the cloud of a single atomic electron; Action of radional field on material bodies in it; A hydrodynamic model of interaction of radional field with matterons (general name for fundamental particles); "Curvature" of radional field around material bodies in it; The origin, structure and function of the universal force F_u; The nature of electricty and magnetism; Imponderable matter in material bodies; Magnetic moments of matterons and stars; The two limits for contraction of stars; Structural limits (forbidden zones) for $r\rho$ and $r^2\delta$ of stars; The cosmological redshift; On the singlarity of collapsing black holes; A small neutrino flux from the sun; The universality and veritability of the Radional Field Theory; Experiments planned. Other related topics are heuristically discussed. The purpose of this research is to develop a synthetic theory of unified field and matter, and their interactions.

*SHNEIDEROV, A. J. "An Outline of the Radional Field Theory", Astronautica, no. 4, 1962, pp. 17-26.

111-120A ENERGY (POLICY) MON., 13 FEB., 3 P.M./ SA COMMITTEE

111. Environmental Issues in Coal Use - A Future Perspective A. ROGER GREENWAY (Fred C. Hart Associates, Inc.)

As the nation moves toward achieving the goal of increased coal utilization in an environmentally acceptable manner, significant technological advances must be accomplished in order to overcome the constraints of air quality regulations such as nonsignificant deterioration, non-attainment area, associated solid waste impacts, and water quality legislation.

It is questionable that projected electric generating capacity can be economically sited to comply with ever tightening environmental legislation. Trade-offs between air, water, and solid waste constraints will guide future siting decisions.

112. The Relationship of HTGR Fuel Failure Models to Potential Off-Site Doses. MICHAEL TOKAR (U. S. Nuclear Regulatory Commission*), WALTER F. PASEDAG (U. S. Nuclear Regulatory Commission*), and PETER M. WILLIAMS (U. S. Nuclear Regulatory Commission*).

In a High Temperature Gas-Cooled Reactor (HTGR) the fuel particle coatings serve as the primary barrier to fission product release (in a way analogous to the cladding in light water reactor fuel rods). The ability to predict the performance of these coatings is, therefore, a requisite to the calculation of potential fission product release from the reactor in the event of postulated accidents. In this paper we demonstrate the dependence ofthe calculated potential off-site doses on the fuel failure values used as input to the calculations.

The resultant doses are compared with (1) the doses obtained from the NRC fuel failure model developed for the Summit HTGR application, (2) the doses calculated by General Atomic, (3) the guideline values of the Federal Regulations (10 CFR 100), and (4) doses calculated for a light water reactor (PWR).

The use of the modified fuel failure model results in an order of magnitude reduction in the calculated 2-hour thyroid dose compared with federal guideline values and doses calculated for a PWR with similar power and site parameters, but the 30-day dose is not significantly altered. Verification of the modified fuel failure model with appropriate data could impact future HTGR design.

*This paper expresses the views of the authors, and not necessarily those of the Nuclear Regulatory Commission.

113. Crude Oil Pricing and Future U.S. Production. CHIA SHUN SHIH (University of Texas at San Antonio, San Antonio, Texas 78285), EDWIN MAMPE (Economic Regulatory Administration, Department of Energy Washington D.C. 20461).

The discrepancy between future crude oil supply and demand has been highlighted as the crux of our pending energy crisis. This paper will review the projections of U.S. crude oil production by different models under various pricing scenario. The reality of domestic crude oil pricing control will then be discussed. In pursuant to the stimpulations in the Energy Pricing and Conservation Act, the Energy Conservation and Production Act and the National Energy plan, a multiple tier pricing structure for domestic crude oil productions has been developed. Based on the recent analysis on finding rate, finding costs and production costs, especially those for frontier areas, the perspectives of U.S. crude oil production under the existing pricing incentives will be assessed.

114. Energy and Equity in Rural Areas. GREGORY A. DANEKE (Division of Environmental and Urban Systems, Virginia Polytechnic Institute and State University).

This paper presents the findings of a portion of the survey research effort recently conducted in rural Virginia on a research grant from the National Science Foundation. Several questions in survey were designed to generate a scale of total personal energy usage. By cross-tabulating this scale with other survey indices (such as: education, income, policital involvement, race, environmental values, etc.) indicators relevant to the formulation of effective and equitable energy are explored. In particular, the impact upon certain demographic groupings of national energy strategies is forecasted.

115. Available Data on the Front End of the Nuclear Fuel Cycle in the State of New Mexico. BETTY L. PERKINS* (Energy Resources Board, State of New Mexico).

Data on uranium mines, mills, and tailings piles located in New Mexico is tabulated including location, size, throughput, ore grade processed, status of project, employment, discharge points, and air and water discharge rates. Stationary source emissions including background are calculated using data given in the tables and emission factors given in the literature. Lack of data for the determination of emission factors causes possible significant errors in these calculations. Thus the need for more accurate emission factors is apparent.

*On loan from Los Alamos Scientific Laboratory.

116. The Utilization of Solar Energy in Developing Countries: Identifying Some Potential Markets. TOUFIQ A. SIDDIQI (Environment and Policy Institute, East-West Center, Honolulu, Hawaii), GERALD F. HEIN (NASA Lewis Research Center, Cleveland, Ohio).

In a recent study (1), we examined the total fossil-, uranium-, and hydro-energy reserves of all developing countries with a population greater than one million, and classified them according to their ability to meet their present and projected energy demand for 1990 from the domestic energy sources mentioned above. This paper focusses on two groups of countries: (1) countries unable to meet even 10% of their present energy requirements domestically and (2) countries unlikely to meet 10% of the projected higher energy demand for 1990 from domestic sources. It is our opinion that these groups of countries represent prime markets for the utilization of solar energy.

Data provided for each of these countries include population density, present and projected energy consumption, per capita GNP, domestic production of copper and bauxite, as well as the balance of payments situation. Climatic data are also included, and used to estimate the cost of solar thermal energy (for heating), and for solar photovoltaic electricity in each country.

(1) Siddiqi, Toufiq A. and Hein, Gerald F. "Energy Resources of the Developing Countries, and Some Priority Markets of the Use of Solar Energy," (to be published).

117. A Note on the Changing Structure of the Soviet Power Industry. B. ROSS GUEST (Northern Illinois University)

A recent decision by the Soviet Union to place a greater emphasis on the use of hydroenergy, atomic energy, and cheap low-grade coal to generate electricity is yet another indication that the U.S.S.R. is continuing to seek ways of economizing its supplies of petroleum and natural gas. The present plan for electricity calls for an increase of about 30 percent during 1976-80 with the annual output scheduled to reach approximately 1,380 billion kilowatt hours by 1980. Probably more significant, however, than this modest increase in electrical production is the changes that are envisaged for the types of generating plants. The most rapidly growing sources of electric power are to be nuclear energy and hydroenergy. The combined generating capacity of these two sources is to rise by 55 percent, with nuclear power alone increasing more than 300 percent. Nearly two-thirds of the planned hydro capacity is to be installed east of the Ural Mountains while all of the new nuclear generating capacity is to be constructed in European Russia. The most important changes slated for the thermal sector are a decrease in the number of new thermal stations started and a greater emphasis on the use of solid fuels. About one-fourth of the new thermal capacity for 1976-80 is to be as minehead stations associated with Siberian and Middle Asian strip mines. Of the 70 million kilowatts of new generating capacity to be installed during 1976-80, 54 million kilowatts are to be added to existing power stations and 16 million are to be installed in new stations. This paper examines the projected changes in the Soviet power industry and attempts to assess the importance of these changes.

118. Behavior of Alkali and Alkaline Earth Elements in Uranium Deposits with Application to Problems of Radioactive Waste Site Selection: I. Oklo. DOUGLAS G. BROOKINS (University of New Mexico)

The behavior of alkali and alkaline earth elements in sites under consideration for radioactive waste disposal is of extreme importance. Studies of the Oklo Natural Reactor, Gabon indicate redistribution of much, but certainly not all, fissiogenic Rb, Sr, Ba and, by inference from Ba isotopic systematics, Cs. Reactor zones (i.e. uranium ore with 10-60% U and depleted in 235-U due to fission) have not retained most of their Rb, Sr and Cs while the fate of Ba is uncertain. Comparison of the reactor zone material with samples from just outside the reactor zones (i.e. no depleted 235-U) indicate the presence of small amounts of fissiogenic Rb and Sr in both, suggesting local redistribution. Evidence for preservation of fissiogenic 135-Cs and 137-Cs (now present as 135-Ba and 137-Ba respectively) is noted in the reactor zone samples whereas normal Ba is noted in the peripheral samples. All available data argue for retention of alkali and alkaline earth elements for at least 25 million years after cessation of the nuclear reactions at about 1.8 billion years ago. Retention of Ra is indicated by (a) corrected model 238-U: 206-Pb dates of 1.8 b.y. (i.e. Ra loss would cause age lowering) and (b) preferential Ra fixation to Ba fixation due to differences in solubilities of $RaSO_4$ and $BaSO_4$.

119. Behavior of Alkali and Alkaline Earth Elements in Uranium Deposits with Application to Problems of Radioactive Waste Site Selection: II. The Grants, NM, Mineral Belt. DOUGLAS G. BROOKINS (University of New Mexico)

In the Grants Mineral Belt, NM, study of authigenic clay minerals by the Rb-Sr geochronologic method yields valuable information about the age of sedimentation and periods of uranium mineralization. Authigenic montmorillonite removed from the ore zones yields a probable age of sedimentation of 145 ± 10 million years (m.y.) while vanadiferous chlorite, which formed penecontemporaneously with the uranium minerals, indicates ages of mineralization at about 138 ± 8 m.y. in the Ambrosia Lake District and 112 ± 8 m.y. in the Jackpile-Paguate area of the Laguna District. These data argue for closed system conditions in excess of 100 m.y. ago for Rb (and Cs by analogy) and Sr. U-Pb dates vary but a reasonable minimum age is approximately 100 m.y., thus indicating that in the 238-U decay chain the maximum amount of 226-Ra loss is less than 20%. The presence of Ra-enriched barite indicates local redistribution. Of further interest is that the vanadiferous chlorites are enriched in elements from Z=40 to Z=60 plus Pb, Bi and Th. These elements are representative of many formed during nuclear fission. The conclusion is drawn that argillaceous sedimentary rocks in tectonically stable areas would, under reducing conditions, be suitable for radioactive waste repositories.

120. Site Selection Criteria for Geologic Disposal of High Level Radioactive Waste. CHARLES D. HOLLISTER (Dept. of Geology & Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543), DAVID A. DEESE (Program for Science and International Affairs, Harvard University, Cambridge, MA 02138)

Progress in the debate concerning the disposal of HLRW may be advanced by early consideration of the basic criteria used for site selection. We assume a) the problem exists now--regardless of future energy policy, b) the waste contains both fission products and long lived actinides, c) it must be isolated from the biosphere for periods of the order 10^5 years, d) it will be disposed of on planet Earth, e) and HLW disposal is an international problem and may require innovative institutional management. These assumptions require site selection criteria be based on maximizing containment and isolation. Man's inability to containerize wastes for 10^5 years, and the present lack of public confidence in long-term guarantees on engineered structures, require the principal barrier to release be the geologic media of the repository. This suggests the media be highly confining to the waste form, be relatively impermeable, and be viso-elastic i.e., able to self-heal. The site should have a demonstrable history of stability for the order of 10^6-10^7 years such that environmental prediction is credible. Sites should be located in the most isolated, stable and useless areas on our planet. Certain submarine geologic formations satisfy these criteria.

120a. Calculating the Effectiveness of Energy Conservation Programs.* GEORGE W. HINMAN, KENNETH BERGSTRESSER, and WALTER BUTCHER (Washington State University).

Computational procedures have been formulated to calculate the combined energy savings of several energy conservation measures, each implemented by a combination of policies. The calculations take account of the fact that effects of different policies applied to a given measure are not additive and the fact that some measures are additive while others are not. The savings are calculated as a function of time using a natural rate of adoption plus the effects of new policy. A Fortran computer program has been prepared based on the algorithms developed, and calculations have been carried out for various conservation scenarios in the Pacific Northwest using a library of fifty four conservation measures combined with policies. The code has also been used to generate a conservation "supply curve," i.e. cost versus amount supplied, so that conservation can be compared to other supply sources so far as cost is concerned.

*Work partially supported by the Northwest Energy Policy Project.

121-131 ENERGY (DECENTRALIZED) TUE., 14 FEB., 9 A.M./ SA COMMITTEE

121. Soft Path Energy Futures. RICHARD MALLOCH (Department of Energy).

The Department of Energy has a clear responsibility to examine and evaluate public policy issues pertaining to energy development. Amory Lovins has recently raised questions concerning the existing energy development emphasis. Should the Department decide to take these seriously, it must proceed to develop a comprehensive "soft" Federal Energy agenda. Such an agenda would explore the technological and science R,D&D issues - such as resource supplies, end-use efficiencies, and feasibility - but, also, institutions, environmental and implementation issues. Methods for analyzing energy futures within the Federal Government may have to be extended or new approaches may be to be stimulated. Through research/analysis efforts currently underway in the Office of the Assistant Secretary for Environment, Department of Energy, a summary will be provided addressing: (1) the approach currently utilized to address "soft" energy options; (2) the information required to evaluate a "soft" energy technology; and (3) a preliminary listing of "soft" energy technologies and their potential applications.

122. Soft Path Energy Futures: How To Get There From Here. RICHARD HOLT (Department of Energy).

Public policy methods for achieving "soft path" energy futures are described. Problems and opportunities are discussed in eight broad categories: (1) removal of institutional barriers, (2) desubsidization of "hard path" technologies, (3) moves toward long-run marginal-cost pricing, (4) reduction of conversion and distribution losses, (5) improvements in end-use efficiency, (6) development of transition measures, (7) replacement of existing capital stocks by attrition, and (8) use of existing social and market processes. These policy measures are described in terms of a major study of soft-path futures currently underway within the Department of Energy.

123. Characterization and Quantification of Environmental Impacts of Decentralized Energy Systems. JOHN NAGY and WALTER A. SEVIAN (Brookhaven National Laboratory).

To assess the environmental impacts of decentralized systems and future energy scenarios, every aspect of the systems and subsystems must be characterized and quantified. These numbers are then used (a) to estimate the total impact of different systems and scenarios and (b) to compare the relative impacts of systems and scenarios. The level of disaggregation must be large, especially in the case of decentralization, primarily because (a) the number of options available in terms of inputs used, output uses, and details of the technology and (b) specific impact coefficients are a strong function of the scale of the technology used. Each technology which is of possible use in decentralization will be identified. These will fall under the general categories of energy source, extraction technique, intermediate energy forms, conversion processes, by-product use, back-up techniques, storage techniques, transportation/distribution, and utilizing device. The problem of scale will be treated in an analytic manner as opposed to the use of ranges of coefficients or a single average number which are either useless or misleading. This paper will present the methods used to develop impact functions and their application to energy systems and scenarios. The impact functions of technologies used in decentralized energy systems and their numerical values will be shown. The impacts themselves will be disaggregated to the largest degree possible and cover the full range of environmental effects.

124. A Discussion of Some Technical Characteristics of "Appropriate" Technologies. MATTHEW K. RECKARD (Brookhaven National Laboratory).

The paper presents a brief overview of several technologies from a technical perspective, including solar, wind, small-scale hydroelectric, and the conversion of organic wastes. Several areas are touched upon, including the potential magnitude of energy supply available through the use of the technologies, their cost, and the requirements of their production and operation. Difficulties encountered in trying to develop an energy system relying primarily on renewable resources are discussed, including difficulties in supplying fuels for transportation and high-temperature industrial processes.

125. Transition to a Decentralized Energy Future. WILLIAM MARCUSE (Brookhaven National Laboratory).

An alternative energy future characterized by a changed energy consumption "ethic" and based upon "soft" technologies has been proposed. It is attractive not only in that it projects a shift from non-renewable to renewable energy sources but also in that it predicates increased control of the individual citizen over the political, social and technical environment. This paper does not address the likelihood, economic feasibility, or social adjustment necessary to achieve the goal of a decentralized energy future. Instead, it addresses the question of making the transition, given that the existing energy using infrastructure is in place and that the new system comes into existence through the addition of new and replacement capital stock. The analysis is performed at the level of the use of energy services. The methodology is to assume two populations, one an extension of current practices and the second characterized by the new consumption patterns and supply technologies. This model greatly oversimplifies the problem but should provide insight into the transition characteristics.

126. Energy Efficiency in Decentralized Energy Systems. GEORGE LEPPERT, SHYANG-LAI KUNG, and DAVID G. STREETS (Argonne National Laboratory).

One set of alternative U.S. energy policy proposals is characterized by the accelerated development of renewable, diverse energy flows (e.g. solar heating and cooling, wind, biomass), matched in scale, geographic distribution and energy quality to end-use needs, which are described by advocates as flexible, easy to understand and employing relatively low technology. Fundamental to these proposals and inherent in the concept of energy quality matching is the requirement of greater thermodynamic efficiency, of making each unit of primary energy perform several times as much social function as it might otherwise do. This paper reviews the thermodynamic concepts underlying energy conversion efficiency and suggests that there may be contradictions inherent in significant efficiency improvements accompanied by the increased use of small scale, low technology, flexible energy systems. The need to reduce thermodynamic irreversibilities -- e.g. friction, turbulence, heat transfer with substantial temperature differences -- implies sophisticated design, fabrication, and operation of energy conversion equipment. Significant improvements to thermodynamic efficiency through decentralization, such as co-generation and district heating, are discussed, as are economic and environmental advantages from inherently small and medium-sized energy sources -- e.g. small hydro, farm waste.

127. Homeowner Perceptions of Energy-Conserving Practices. DOROTHY LEONARD-BARTON and EUGENE ROSA (Stanford University).

Two-thirds of the American public now believe in the reality of an "Energy Crisis"; most have taken some minimal conserving actions in their lives. However, more conservation constitutes the U.S.'s cheapeast source of energy for the future. The conservation undertaken by the American public so far has resulted in relatively insignificant savings. Moreover, only a minority of the potential savers has consciously conserved. It is therefore of great interest to policy makers, manufacturers of energy conserving devices, educators, etc., to know how conservers differ from non-conservers and why. What criteria do people use to decide on personal conservation patterns, and what factors beyond price influence that decision? A clearer understanding of these criteria can contribute to effective conservation policy. This paper will: (1) Review existing literature on the acceptability of a wide range of energy conserving practices to the public, with the objective of identifying the salient factors affecting the adoption of such practices. This objective adopted and why and to obtain a better understanding of what (beyond background demographics) distinguishes conservers from non-conservers. (2) On the basis of the identified factors, raise hypotheses about the most effective social marketing techniques for promoting conservation. (3) Present findings of a Fall 1977 homeowner survey in the San Francisco Bay Area, designed to refine the dimensions utilized by homeowners in deciding on conservation practices.

128. Environmental Aspects of Decentralized Energy Systems. SHYANG-LAI KUNG, DORIS B. GARVEY, and DAVID G. STREETS (Argonne National Laboratory).

In the last few years, there has been considerable interest in alternatives to the centralized, large-scale energy supply technologies which historically have been associated with the continuation of high energy growth rates. Research programs in both the governmental and private sectors have been initiated to investigate decentralized energy systems (DES) as a way of both reducing the nation's dependence on depletable energy resources and limiting pollution to the environment. Although the environmental consequences of DES are probably favorable, they have not been fully examined. In this presentation, DES are divided into four basic categories, namely, renewable energy sources, nonrenewable energy sources, improved energy efficiency, and energy storage. The environmental impacts on air quality, water quality and quantity, land use, health and safety, ecosystems, materials and resources, and climate of each system are reviewed. The impact assessment covers the complete cycle of each system from production of materials, manufacture of components, installation and construction, to end use. In addition, the environmental impacts of selected DES and conventional energy production are compared.

129. Hydro Pump Back Wind Energy Conversion Systems (HPB-WECS) for Demand Power Generation. PAUL J. BRENNAN (Syracuse University) and S. ESKINAZI (Syracuse University).

The concept of a hydro pump back wind energy conversion system consists of using energy from a wind turbine located near a hydroelectric station to pump water from the tailrace to the reservoir, thus using the hydroelectric turbine to produce electric power at a constant frequency. It was developed by the authors for a major power utility in the Northeast and is being transfered into a prototype design. The concept has three major assets.
The first is storage. During periods of low runoff when winds are high, water can be stored, and the available per-

iods of peak demand generation can be increased. This occurs in the fall and winter seasons. When both water runoff and wind energy are low, such as in summer, wind can increase the water use availability through recycling.
The second asset is that electric power generation is performed by the hydroturbine and not the wind turbine, thus producing clean electricity at constant frequency.
The third benefit is increased overall yield and efficiency. Since the wind turbine rides the wind the lower efficiencies resulting from maintaining the wind turbine at constant rpm to control frequency do not exist. Storage is easily accomplished. The wind turbine can utilize maximum wind energy to continually pump water into the reservoir. This increases the water available and, for most small rivers for which the hydraulic facilities are designed for water availability of a few hours a day, power production is increased.

130. Effects of Decentralized Electric Generating Systems on the Political Authorities of Local Governments.

MARC MESSING (Environmental Policy Institute).

Technical developments in electric power generation, transmission, and distribution have led to increasing centralization in both the technical and institutional aspects of electric power systems. As a result the jurisdictions of electric power systems have transcended the geographic and political boundaries of local governments and the traditional boundaries of utility regulation.

A study of recent developments in decentralized energy systems indicates that municipal and county governments may retain a higher degree of political autonomy and flexibility in response to socio-political problems through the utilization of decentralized electric generating facilities rather than through participation in large-scale regional energy systems.

Five case studies are examined in detail. Ten additional case studies are referenced.

131. Energy Projects for Developing Countries

Arlene P. Maclin (Morgan State University)

Developing countries' needs for solar energy technology will be assessed. The application of solar energy technology in agriculture, food preservation and sanitation (e.g. distillation of water) will be discussed especially as it relates to African village life where most of the African people live.* Several exotic solar projects will be introduced; their cost effectiveness examined and the feasibility of the adaptation of existing technology for these projects discussed.

*A. P. Maclin and A. O. E. Animalu, Energy, Material Science and Technology in Developing Countries, Ann Arbor Science (in press)

132-141 ENERGY (GEOTHERMAL) TUE., 14 FEB., 3 P.M./ SA COMMITTEE

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132. Environmental Investigations of the Los Alamos Scientific Laboratory's Hot Dry Rock Geothermal Demonstration Project.

KENNETH H. REA (Los Alamos Scientific Laboratory).

Los Alamos Scientific Laboratory's (LASL's) hot dry rock (HDR) geothermal project is the first attempt to extract thermal energy from a known geothermal reservoir which lacks wtaer. Two deep holes have been drilled into a hot granitic substrate, connected by a hydraulic fracture, and thermal energy brought to the surface by circulating water through the system. The environmental objectives for this project are to: (1) establish both biotic and abiotic inventories of the ecosystem at the LASL HDR site, (2) identify and quantify key ecosystem components, and (3) determine the severity of the LASL HDR facility's impact on the local environment.

Results to date include biotic inventories with the identification of several key species upon which future studies will concentrate. Three vegetative complexes have been identified and permanent study sites have been selected in each to measure various parameters. Sampling programs have been initiated to measure several population parameters for large mammals, small mammals and birds. Programs in water quality, seismology, and climatology also exist.

133. Los Alamos Hot Dry Rock Geothermal Energy Project.

ROLAND A. PETTITT (University of California, Los Alamos Scientific Laboratory).

The LASL Hot Dry Rock Geothermal Energy Project is the only U.S. field test of this huge geothermal resource. In the LASL concept, a man-made geothermal reservoir would be formed by drilling a deep hole into relatively impermeable hot rocks, creating a large surface area for heat transfer by fracturing the rock hydraulically, then drilling a second hole to intersect the fracture to complete the circulation loop. In 1974, the first hole was drilled to a depth of 2929 m (9610 ft) and a hydraulic fracture was produced near the bottom, in 200°C granitic rock. During 1975, a second hole was directionally drilled to intersect the fracture. Although the desired intersection was not achieved, a connection was made through which water could be circulated. After more than a year's study of the fracture system, drilling began again in April 1977 and an improved connection was achieved. On September 26, 1977, the first 5 MW (thermal) heat extraction and circulation experiment was begun to test the concept, and was successfully concluded four days later. These two holes constitute most of the U.S. drilling and fracturing experience in hot crystalline rocks using conventional oil field equipment.

134. Deformation of Dry Andesite and Granodiorite at Temperatures to Partial Melting and Pressures to 50 MPa.

M. FRIEDMAN, J. HANDIN, N. G. HIGGS (Center for Tectonophysics, Texas A&M University, College Station, TX. 77843).

Energy extraction from magma requires stable boreholes at depths < 10km in rocks at temperatures > 0.5 Tm. Accordingly, failure strengths and associated deformation mechanisms of dry Mt. Hood Andesite and Charcoal Granodiorite are determined at temperatures to partial melting (>1050°C), at confining pressures of 0 and 50 MPa, and strain rate of 10^{-4} sec^{-1}. Average strength reduction of the andesite is linear at both pressures with gradients of 1.2 and 3.3 MPa/25°C, from 25°C-strengths of 125 and 305 MPa at 0 and 50 MPa, respectively. For the granodiorite at 50 MPa the gradient is linear at 10.7 MPa/25°C, but unconfined it is nonlinear from 350 MPa at 25°C to 35 MPa at 1000°C. Strength vanishes at partial melting with viscosity at about 10 MPa·s (10^8 poises). Both rocks are brittle throughout the temperature range until melting occurs. Both rocks deform primarily by precursive microscopic extension fractures that coalesce into macroscopic faults. These fractures increase with increasing temperature. Considerations of instantaneous failure-strengths and stresses likely at the walls of open and water-filled boreholes show that a hole as deep at 10 km in either dry rock is not likely to fail under short-time loading even at 1000°C, unless the in-situ horizontal stress is ≥ vertical stress and the hole is open. The effects of water-weakening and duration of loading are now being investigated.

135. Simulation of Volatile Atmospheres for Magma Energy Research.* TERRENCE M. GERLACH (Sandia Laboratories).

Definition of the composition of magmatic volatiles is critical to the selection of materials for magma energy extraction systems. Characterization of magma properties of importance to magma energy research (density, viscosity, surface energy) also requires knowledge of volatile components. Thermochemical studies of existing volcanic gas collection data have been used to remove chemical modifications imposed during collection procedures, and to construct an improved volcanic gas collection device. The restored data for 40 recent volcanic gas analyses consist mainly of H_2O, CO_2, and SO_2 in highly variable proportions, however uniform compositions are displayed at each collection site. Volatile solubility data and analyses of volatiles in quenched glasses of submarine lavas have been used to simulate volatile atmospheres for basaltic magmas at pressures up to 200 MPa. These calculations indicate high pressure magmatic gases will be characterized by larger CO_2-H_2O ratios and significant increases in H_2S and S_2 relative to SO_2.

*This work supported by the United States Department of Energy.

136. Magma as a Potential Source of Fuels.* TERRENCE M. GERLACH (Sandia Laboratories).

Thermodynamic and experimental studies indicate that fluids containing up to 3 mole percent H_2 result from the interaction of fresh water and seawater with hot basaltic glass or magma. The cumulative H_2 potentially recoverable from a cubic kilometer of basalt is on the order of 2×10^{12} grams (about 20 percent of the total 1975 U.S. hydrogen consumption). Addition of organic matter to the injected fluid considerably enhances fuel production and allows fuel generation directly using only magma or hot rock thermal energy. For example, mixtures containing 10 wt. percent cellulose ($C_6H_{10}O_5$) form 5 to 15 mole percent H_2, CO and CH_4 depending on temperature. The properties of hot basaltic rocks and magmas in mid-ocean ridge environments offer the most favorable conditions for magmatic fuel production. The engineering feasibility of future fuel production from magma and hot rock is being investigated in conjunction with magma thermal energy extraction.

*This work supported by the United States Department of Energy.

137. The Extraction of Heat from Magma Bodies. HARRY C. HARDEE, JR. (Sandia Laboratories) DAVID W. LARSON (Sandia Laboratories).

Analytical heat transfer techniques are used to relate geological surface evidence and observations to conditions that are likely to exist in magma chambers. An experimental heat exchanger was tested in a molten lava source heated by an induction furnace. Design work has been started on a prototype long tube heat exchanger. This information is being used to make estimates for commerical heat extraction rates. Calculations and surface heat flow measurements indicate that the steady-state heat extraction rates for shallow convecting magma chambers with low superheat will probably be on the order 10 kw/m^2 or less and a lower limit of around 1 kw/m^2 will occur for conduction dominant magma chambers. Preliminary cost comparisons indicate that magma power would be competitive with conventional power plants at magma heat extraction rates of 4 kw/m^2 or more.

138. Upmelting in Magma Bodies. HARRY C. HARDEE, JR. (Sandia Laboratories) DAVID W. LARSON (Sandia Laboratories)

Analytical and numerical heat transfer calculations are used to show that upward melting magma systems tend to be approximately equidimensional with height to width ratios limited to around seven or less. This agrees with observations on the magma body beneath Yellowstone which appears to have a height/width ratio of five. Experiments run in the laboratory with model simulants such as paraffin also confirm the predictions. Injected magmas with very high height/width ratios appear to be formed by a forced convection process which involves little, if any, melting or natural convection.

139. Surface Heat Flux Distribution Above Magma Sources. HARRY C. HARDEE, JR. (Sandia Laboratories) DAVID W. LARSON (Sandia Laboratories)

Analytical heat transfer techniques are used to calculate the surface heat flux distribution above rectangular (dikes) and spherical magma sources. The solutions are concerned primarily with steady-state effects in a conduction dominant region overlying the magma body. Transient effects are included for the spherical case. This study has application in the location of magma bodies. The surface heat flux distributions can be used to estimate characteristics of the magma body such as extent of the body and depth.

140. A Chemical Characterization of Pollutants Released During Geothermal Energy Development. D. E. Robertson, J. S. Fruchter, J. D. Ludwick, C. L. Wilkerson, E. A. Crecelius, J. C. Evans (Battelle Northwest, Richland, WA 99352)

The high temperature magmatic processes which create the hydrothermal provinces of valuable geothermal energy potential also result in the accumulation of undesirable gases and liquids. During the tapping and utilization of geothermal fluids for power production, elevated levels of these naturally-produced contaminants can be released to the surrounding environment. During the past two years we have been engaged in a study to identify the quantities and chemical forms of volatile and water soluble metals and gases released in geothermal effluents. To date, our studies have been conducted at The Geysers, California; Cerro Prieto, Mexico; Niland, California; East Mesa, California; Heber, California; Raft River, Idaho; and Vermillian Bay, Louisiana. The contaminants of major environmental concern include hydrogen sulfide, boron, mercury, ammonia, arsenic, and in the case of the high salinity geothermal brines, salt. These constituents, plus a large number of other trace elements and gases have been characterized in geothermal effluents, and their pathways of release to the environment for geothermal power plants have been determined.

141. Geothermal Energy in Imperial County, California: Research Conclusions and Policy Implications. MARTIN J. PASQUALETTI (Arizona State Univ.), JAMES B. PICK (Univ. of California, Riverside), EDGAR W. BUTLER (Univ. of California, Riverside).

Recent research on environmental aspects of potential geothermal energy development in Imperial County, California, reveals major and often complex potential problems in the areas of land subsidence, seismic activity, noise, air pollution, land displacement, power transmission corridors, and others. County population will interact with energy development through employment, geographical distribution, interaction with the large Mexican labor pool, etc. A public opinion survey of Imperial County residents shows, among other results, that almost 90% of the people favor development. From these research results general policy conclusions applicable to other KGRA's in the western U.S. were drawn, and include disirability of positive public opinion, encouragement of on-line electrical power at a very early stage in the development process, importance of determining economic-technological exploitation feasibility, and the influences of local, state, and federal regulations. Fourteen policy recommendations specific to Imperial County are made.

142. Effects of Underground Coal Gasification on Ground-water Quality. J. H. CAMPBELL (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

Ground-water sampling and analysis have been carried out at the site of an in situ coal gasification experiment conducted by the LLL near Gillette, Wyoming. An important environmental question associated with in situ gasification concerns the possibility that reaction products (ash and tars) left underground following the gasification process may lead to the contamination of local ground waters. In an effort to clarify the significance of this problem, we have sampled the water from more than 12 wells in the vicinity of an underground gasification experiment before, during, and up to 6 months following gasification. Water samples were analyzed for a variety of characteristics, including 70 inorganic elements and compounds, phenolic materials, dissolved organic carbon, and volatile organics. We find a greatly increased concentration of phenolic material just outside the burn boundary, and a variety of inorganic species issuing from within the residual ash bed. All contaminants decrease rapidly with distance, although above-background levels of some species were detected 100 feet from the burn zone. Several important contaminants showed a large decrease in concentration with time as a result of adsorption on the coal matrix.

143. Generalized Models for Rock Response to Stress. R. N. SCHOCK (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

It is commonly necessary to fracture a resource for purposes of economically feasible extraction or in situ processing. Laboratory experimental data of three-dimensional stress-strain behavior can be used to predict the response of rock to explosive or impact loading by identifying the important parameters which determine that response. These data have demonstrated the importance of shear stress, mean pressure, and strain rate, in defining explicit regions of behavior. Brittle rocks exhibit a characteristic strength followed by rupture, and a pronounced inelastic volume dilatancy before they fail. Some rocks fail in a ductile-like manner, and confining pressure is known to enhance this effect. However, increasing strain rate has the effect of enhancing brittle behavior. Porosity has a strong effect on the response of rocks to stress, the pore fluid and shape, as well as the matrix serving to control the observed behavior. Observations such as these as a guide in the development of models for use in predicting the effects of stress on rock.

144. Use of Electrical Techniques to Monitor In Situ Processes. A. DUBA, R. J. LYTLE (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

Measurement of electrical transmission, especially at high frequency (10^5 to 10^8 Hz), has a demonstrated potential for monitoring processes such as in situ coal gasification, oil shale retorting, and solution mining. Large changes in the electrical properties of coal and oil shale occur as the result of laboratory retorting. These studies also indicate that electrical measurements may be used to monitor fluid flow. Field measurements have detected the progress of the retort zone during in situ coal gasification and have been used also to follow the paths of injected fluids in coal seams. Between boreholes about 100 m apart, uncertainties in location of zones of interest may be as small as 0.5 m.

145. Application of Geochemical Data to the Development of Uranium Resources. D. L. LEACH, JR. (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

Uranium is mobile under most geological environments; therefore, uranium in stream waters and sediments provides information on surficially exposed uranium occurrences while uranium in groundwater is effective in identifying subsurface uranium occurrences. This provides a rapid, effective method to identify new uranium resources. To conduct an effective geochemical survey, a sampling program must be devised that is specific for a geological environment. In addition to uranium, sufficient geochemical data must be developed so that true uranium anomalies can be determined from background levels and false anomalies. Uranium saturation calculation, ion ratios, and various statistical methods are useful for interpreting uranium in waters. The interpretation of uranium in sediments is greatly facilitated by multi-element analyses provided by neutron activation analysis and emission spectrometry. These data permit mineralogical and chemical characterization of the sediments, and provide a basis for predicting anomalous uranium concentrations.

146. A Review of Soviet Nuclear Explosions for Energy Resource Development. M. D NORDYKE (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

Over the last 10 years, the Soviet Union has developed a very active program using nuclear explosions for peaceful purposes, many of which are directly related to energy resource development. The Soviets have discussed in general terms the types of applications in which they are interested; however, they have described in some detail only a few specific projects. Of particular interest for energy resource development is the use of nuclear explosions for the creation of underground hydrocarbon storage facilities, closure of runaway oil and gas wells, stimulation of oil and gas formations, and deep seismic soundings to define the detailed structure of the upper mantle and crust. Details provided by the Soviets, as well as other seismic evidence, indicated these applications are actively being pursued and, in some cases, appear to be in routine industrial use.

147. Chemical Modification of Hypersaline Geothermal Brine for Scale Control. L. B. OWEN, (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

Prototype thermal energy conversion systems processing geothermal brine can be jepordized by severe scaling problems that arise when the brine undergoes evaporative cooling. Field studies in the Imperial Valley, Southern California have demonstrated that massive siliceous scaling can be prevented when brine, while still at well-head conditions, is acidified with hydrochloric acid. Preliminary evaluations indicate that reagent requirements for acidification add about one to two mills per killowatt hour to the price of power depending upon the energy conversion system employed. The rationale for scale control by acidification was based on the premise that the polymerization-condensation kinetics that control the rate of silica precipitation are pH-dependent.

148. Baseline Measurements of Geologic Events Can Remove Potential Roadblocks to Geothermal Development. P. W. KASAMEYER, N. B. CROW (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

Large-scale production of electricity from geothermal fluids in southern California may possibly cause adverse environmental effects such as water pollution, earthquakes, or subsidence. The LLL Imperial Valley Environmental Project, in cooperation with several organizations, is making baseline measurements of water chemistry, seismology, and surface elevation before production starts. Natural geologic events have been observed which might have been considered environmental effects of production had full production been in progress. Documentation of the variability of natural geologic activity is reducing the risk that public reaction to a natural event will stop production. One event was an earthquake swarm. Fewer than 40 earthquakes per month were detected near the Niland field in 5 months. Over 300 earthquakes occurred in the sixth month. Assuming the events had a stationary Poisson distribution, the change in seismicity is highly improbable. Because the natural seismicity rate is variable it is not a practical discriminant between natural and production-related events. The depth-of-focus or source-mechanism may be a better discriminant.

149. Calculational Modeling of Explosive Fracture in Natural Resource Formations. P. S. BROWN, D. E. BURTON, T. R. BUTKOVICH, J. F. SCHATZ, C. M. SNELL. (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

High explosives may be used to fracture geological formations containing recoverable resources. Often the goal is to enhance permeability and thereby facilitate in situ recovery. We desire to predict the extent of fracture and its effect on permeability. Fracture is caused by complex interactions between the generated stress waves and the rock media. Experiments by themselves do not provide much information about these interactions; hence, we use computational models as a tool to study in detail how wave interactions lead to fracture. We have developed 1-D and 2-D Lagrangian wave propagation codes that model the constitutive-failure behavior of geologic materials and use multi-dimensional graphics to display the complex wave effects. Fracture parameters calculated by the codes have been related to observed extent of fracture and enhanced permeability in two underground experiments in coal. We are now working on improving our models to better quantify the relationship between observed enhanced permeability and calculated fracture. This will improve our ability to predict these quantities for any charge configuration, explosive, or medium.

150. Microbial Surfactants for Use in Oil Recovery from Athabasca Oil Sands. DONALD F. GERSON (The University of Western Ontario) and J.E. Zajic (The University of Western Ontario).*

The Athabasca oil sands, in Alberta, Canada, are estimated to contain one trillion barrels of oil in place and are thus of considerable economic importance. The oil is highly viscous and is absorbed to sand making extraction difficult and inconsistent. At this time, oil is extracted from oil sand by treatment with hot water at high pH, which separates 80-90% of the oil from the sand but produces an intractable and environmentally hazardous clay slurry as effluent. Alternatively, oil may be extracted by treatment of the oil sand with cold-water plus surfactants , which is known to result in similar yield if certain surfactants are used. Microbes which utilize liquid hydrocarbons as primary carbon source produce surfactants during growth. Some bacterial cultures produce surfactants which greatly enhance oil recovery from Athabasca oil sand. The use of surfactant produced by *Corynebacterium lepus*, sp. nov. in a cold-water extraction process results in greater yields than those obtained with some of the most promising synthetic surfactants and offers considerable cost and production advantages when compared to synthetic surfactants. This microbial surfactant has been tested and found to be non-toxic and microbially biodegradable.

* This work was supported by the Canadian Department of Energy, Mines and Resources.

151. A METHOD FOR NONDESTRUCTIVE ANALYSIS OF ORGANIC SULFUR IN COAL: ELECTRON PROBE MICROANALYSIS
R. Raymond and R. Gooley, Geological Research Group, Los Alamos Scientific Laboratory, Los Alamos, NM 87545

A standard for quantitative electron probe microanalysis of organic sulfur in coal has been prepared and tested. The standard consists of spherical carbon beads 75 to 200 µm in diameter that contain 4.1 ± 0.1 weight percent sulfur. Having a composition very similar to coal, the new standard eliminates potential difficulties which could arise from use of sulfide or sulfate minerals as standards for measurement of organic sulfur in coal.

Data resulting from use of the standard indicate: (1) small area measurements are typical for entire samples; (2) a consistent order is found in organic sulfur contents among various coal macerals regardless of sample locality or coal rank: sporinite > vitrinite ≈ resinite > fusinite; (3) higher organic sulfur content in high-sulfur coal than in low-sulfur coal, but not in proportion to the difference in total sulfur content of the coals; and (4) no organic sulfur gradient within coal macerals near sulfide grains. Analysis of organic sulfur content in macerals is a means for improved interpretation of molecular structures of coal.

152-161 GEOPHYSICAL SCIENCES WED., 15 FEB., 3 P.M./ SA COMMITTEE

152. A Diagenetic Horizon in the Recent Sediments of Lake Huron. ROBERT M. OWEN (University of Michigan).

A 178cm core recovered from the Recent sediments of Northern Lake Huron was subdivided into seven lithologic units on the basis of color, texture and the presence or absence of black bands. Samples from each unit were analyzed for 19 elements, organic-C and CO_3-C. A principal components analysis of these data reveals that the distribution of lanthanide elements (La, Ce, Sm, Eu, Tb), transition metals (Sc, Cr, Fe, Zn) and heavier alkali elements (Rb, Cs) is controlled by silicates, particularly clay minerals, in each unit. Other elements (Na, Th, Ba, Co, Hf) are also correlated with lithology above 94cm, but not below this depth. Because of their low ionic potentials and/or association with humates these latter elements are relatively mobile, and their vertical distribution suggests that sediments below the 94cm horizon have undergone diagenetic alteration. The distribution of Br is exclusively controlled by organic matter, thus displaying a chemical behavior similar to that observed in marine environments. Color differences between the lithologic units are correlated with Ca, Mg and CO_3-C (carbonate minerals), while the black bands in some units may be organic matter or hydrolyzed Fe-sulfides. Finally, the statistical analysis also reveals that two units (40-45cm and 56-94cm) have markedly different compositions relative to other units in the core. This implies that significant changes have occurred in the provenance and/or depositional environment of these sediments since the Pleistocene.

153. Monocarboxylic Acids and n-Alkanes from Sediments as Indicators of Post-Glacial Environmental Changes in the Great Lakes. PHILIP A. MEYERS (The University of Michigan), NORISHIGE TAKEUCHI (The University of Michigan).

The amounts and types of monocarboxylic fatty acids and saturated hydrocarbons have been studied in sediment cores obtained from Lake Huron. Variations in both concentration and composition of these groups of sediment constituents occur over the periods of time represented by these cores. While total fatty acid levels decrease rapidly with depth in the sediment, long-chain and branched-chain acids become more abundant. This suggests both post-depositional alteration of fatty acids and changes in the sources of organic materials to the sediments. Distributional patterns of n-alkanes also indicate changes in sources of organic materials and appear to be useful paleolimnetic indicators. Major changes in n-alkane content are found in conjunction with the ragweed pollen horizon, at a sediment depth corresponding to deforestation of the Lake Huron watershed by logging, and with more recent eutrophication of Saginaw Bay. From sedimentation rates determined by both palynology and Pb-210 dating, sediment in the bottom of these cores has been estimated to have been deposited at times ranging from 300 to 11,000 years BP. Therefore, inferences can be made about causes of earlier variations in acids and hydrocarbons which predate European settlement of the Great Lakes Basin.

154. Persisting Archean Tectonic Patterns in the Fennoscandian Proterozoic. WILLARD S. GRIFFIN, JR.(Chemistry and Geology Dept., Clemson University, Clemson, S.C. 29631).

Map patterns of Middle Precambrian supracrustal rocks in the Fennoscandian shield indicate unusual Proterozoic tectonic processes. These patterns are ragged and amoeba-like. Similar map configurations are common in more ancient Archean (2,000-3,500+m.y. old) deformation belts. Warping of these greenstone and metasedimentary rocks in other shields is attributed to vertical subsidence and lateral crowding associated with diapirism of granitoid plutons. Greenstone belt cratons are separated by linear Proterozoic "mobile belts" of considerable width and length. Thus where together, Archean and Proterozoic tectonics are distinguishable by uniquely different styles. In Finland the 1,850 m.y. old Svecokarelidic deformation and metamorphism has been attributed traditionally to classical linear orogenesis, similar to Phanerozoic mobile-fold belts and perhaps Proterozoic "mobile belts." However,the irregular Finnish map patterns are not easily explained by well-integrated linear orogeny. Instead, the metasedimentary and metavolcanic patterns can be better related to individual granitoid intrusives. These elliptical bodies are responsible for much local complications and diversity. Diapir tectonics which deformed Archean supracrustal assemblages appear to have persisted into Proterozoic time in Finland. Perhaps the Fennoscandian shield was more primitive than other shields during the latter part of the Precambrian.

155. Erosion, Accretion, and Migration of a Barrier Island: An Historical Perspective. DAVID P. BRANNON and STEPHEN V. SHABICA (National Park Service).

Petit Bois Island, located approximately 12 km offshore, represents the eastern boundery of a chain of 4 Mississippi barrier islands. A high degree of shoreline variation results from erosional and depositional processes brought about by seasonal wind, current, and tidal regimes. In response to the dynamic nature of the environment, Petit Bois Island is migrating westward. Port facilities of the Mississippi Sound require maintenance dredging of a channel (12 m deep and 107 m wide) through Horn Island Pass which lies on the immediate western margin of Petit Bois Island. Rapid shoaling in this area necessitates the average annual removal of 471,712 cu m of dredged material. Petit Bois Island, following its separation from Dauphin Island 200 years ago, has migrated 14 km westward, representing an average migration rate of 70 m per year and has lost over 1/2 of its original 24 km length, representing an average decrease in length of 60 m per year. If present island migration and erosion rates continue, in as little as 75 years Petit Bois Island could migrate into the shipping channel and be entirely removed by maintenance dredging. Depending upon the potential longevity of the resource and upon the maintenance of the channel in its present position, various management strategies are applicable to the Gulf Islands National Seashore.

156. Dust Storm on the Eastern Colorado Plains. ERVIN Y. KEDAR (William Paterson College).

Airborne observation of the dust storm on the Eastern Colorado Plains, as seen and photographed from an aircraft, on the 23rd of February, 1977, showed that dust was lifted from selective fields. Steady flow of dust was seen from Nunn-Bresser-Ascalon-Truckton soils and their associations, in a spotty, selective and sporadic form, when wind speed reached its peak of gusts. The equation $E = f(IKCLV)$ by Craig and Turelle, where E is the potential average annual soil loss, has been supplemented with additional variables, such as, the lifting mechanism of the dust; the exact soil characteristics which encourages soil drifting, and the nature of the gusty winds. Soil losses in Arapahoe county, Colorado, was calculated to be at the rate of 80 tons per acre per year, with the soil protection of less than 250 lbs/acre of small grain residue from previous crop. It would seem reasonable to expect from the SCS to direct its effort to systematically seek out and offer assistance to farmers who cultivate the Nunn-Bresser-Ascalon-Truckton soils and their associations in the easterns plains of Colorado.

157. Andesite Genesis and Evolution of Continental Crust J. C. EICHELBERGER (Geological Research Group, Los Alamos Scientific Laboratory, Los Alamos, NM 87545).

A critical problem in crustal evolution is whether the voluminous andesitic volcanoes and cogenetic granodioritic batholiths of magmatic arcs are derived from the mantle, crust, or both. New data on phase assemblages in volcanic and batholithic rocks from five magmatic arcs indicate that andesitic and granodioritic rocks form by mixing of basaltic and rhyolitic magmas. The most likely sources of these parental magmas are the upper mantle and lower crust, respectively. Rhyolitic magma probably forms by about 10% melting of a basaltic (gabbroic) or intermediate source. Crustal melting is apparently due to the transport of heat from the mantle by basaltic volcanism. Once rhyolitic magma bodies develop within the crust, they trap intrusions of denser basaltic magma and mix by convection. Eruption of mixtures is favored over eruption of rhyolite because mixing replenishes heat in the magma body and at low pressure (upper crust) causes vapor exsolution. Hence granite (crystalline equivalent of rhyolite) is more abundant in batholiths than is rhyolite in cogenetic volcanic piles. Consequences of this model are: (1) Early continental (granitic) crust formed by melting of earlier basaltic crust. Critical factors in development of continental crust are heat flow (by conduction or movement of magma), thickness of basaltic crust, and presence of water. (2) Rather than being fed by narrow conduits from the mantle, andesite volcanoes tap large magma bodies within the crust.

158. Strandflats: Must all be pre-Holocene and cut with the aid of ice floes? ROBERT F. BLACK (Univ. of Connecticut).

Rhodes W. Fairbridge at the INQUA Congress, 1977, called for abandonment of the "classic concept of a wide platform of marine abrasion created without the aid of ice floes" and stressed that all classic wave-cut platforms of N.W. Europe were formed only prior to the Holocene. Many strandflats of the Aleutian Islands, which are synonymous with shore platforms, are exceptions to that generalization. On Umnak Island specifically large bars and other deposits equivalent to the amount of material probably removed from adjacent strandflats are unequivocably traceable to them, are obviously post-late Wisconsinan glaciation, and are radiocarbon dated to the mid-Holocene high sea-level stand that lasted 5,000 years. No ice floes are found in the area today. An archaeologic site with a vast midden derived from organisms living on one strandflat spans the last 4,000 years and demonstrates the lack of ice floes. None should have existed during the mid-Holocene as the climate then was warmer than today. The islands do not have a periglacial climate, but frost action, wetting and drying, and chemical alterations comminute the rocks on the strandflats. Storm waves and currents remove them easily. Rates of erosion today of the shoreline, in places recorded by triangulation stations and other evidence, are sufficient, if continued in the past, to cut the platforms during the mid-Holocene without the aid of ice floes. Strandflats in the western Aleutians are smaller than in the east, but the mid-Holocene high sea-level stand was shorter.

159. Mineral Resources Evaluation Using Chilean Archipelago Bottom Sediment Geochemistry. P.P. HEARN (U.S. Geological Survey), F.R. SIEGEL, F.T. DULONG (The George Washington University), J.W. PIERCE (The U.S. National Museum), C. VIEIRA, F. FERRARIS (Chilean Institute for Geological Research)

Bottom sediments from the Chilean Archipelago have been analysed by emission spectrography in an effort to evaluate their use in detecting mineral prospects in hard to reach land areas. Thirty-three elements were present in concentrations greater than their detection limits. Using an arbitrary level above which a concentration could be considered anomalous ($>2\sigma$ above the mean concentration), three geochemical zones were defined: one of Fe and associated elements (Mg, Cu, Co, Sc, V, Ti), another of K and associated Ba and Pb, and a third of Ca and Sr. Correlation coefficient estimates at the 99% confidence level confirm the empirical relations (e.g., Fe-Mg=+0.83, Fe-Cu=+0.66, Fe-Co=+0.94, Fe-Sc=+0.88, Fe-V=+0.86, Fe-Ti=+0.74, K-Ba=+0.91, K-Pb=+0.79, and Ca-Sr=+0.95). By comparing the data with information on regional geology, mineralogic and grain-size data on bottom sediments, and mineralogy and trace element geochemistry of suspended mineral matter, target zones are defined in the Chilean Archipelago for more detailed land geochemical exploration.

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160. Marquette Buried Forest 9,850 Years Old. JOHN D. HUGHES and W. JAMES MERRY (Northern Michigan University).

In 1976-77 Larix and Picea trees in growth position were exposed at depths to more than 6 meters below the surface in constructing a tailings basin for the Cleveland-Cliffs Iron Co. The 1.5 by 5 Km. area is located 16 Km. southwest of Marquette, Michigan and 8 Km. west of the Marquette moraine. Trees with 150 growth rings were collected. The outer layer of a tree was dated at 9,850± 300 ^{14}C.y.a. W3866 (M. Rubin). The trees are rooted in a paleosol 5 to 10 cm. thick containing twigs, needles, cones, mosses, fragments of fungus hyphae and moss rhizoids, and pollen. The trees are embedded in a lacustrine layer of clay, silt and fine sand up to 3 meters. Above this, channels of coarse crossbedded gravel are present up to 3 meters in thickness and finally 2 to 4 meters of medium crossbedded sand. There is no evidence of glacial override such as; distorted strata, sheared trees, or intercalated till. The tips of trees extend into gravel-filled channels as much as 1.5 meters where they were severed by stream abrasion. The evidence indicates a minimum period of plant growth of 150 years following recession of the Great Lakean Stadial. Tree growth was terminated by local ice-marginal ponding caused by glacial readvance into the area. Deposition of lacustrine sediment, capped by outwash gravel, occurred during building of the Marquette-Munising moraine system. We propose that the names Gribben Interstadial and Marquette Stadial be adopted for these events which possibly correlate with the Allerød and Younger Dryas of Europe.

161. The Origin of Terra Rossa. ROBERT D. HALL (Indiana University-Purdue University at Indianapolis).

Red silty clay or terra rossa is the most important surface deposit of karst regions. The accepted theory considers terra rossa to be accumulated insoluble residue from dissolved limestone. However, recent evidence from the karst area of south-central Indiana suggests that terra rossa is primarily a transported sedimentary deposit, not residuum. Detailed investigations of sinkholes suggest a history of transportation of terra rossa sediments by: 1) separate clay and silt zones suggestive of stratification; 2) lacustrine sediments underlying part of the terra rossa; 3) systematic lateral changes in particle size distribution; 4) highly variable thicknesses of the terra rossa at similar topographic positions; 5) sharp contacts between the terra rossa and the underlying limestone; 6) lamination and occasional cross-lamination; and 7) rounded quartz grains within the terra rossa. Furthermore, the geometry of the terra rossa on a regional scale is wedge-like and is similar to that of continental basins in which sediments are shed from adjacent uplands. Finally, the terra rossa is a deposit of complex mineralogy, including variable amounts of illite, chlorite, kaolinite, montmorillionite, and mixed-layer clays. A similar mineralogy characterizes the fine-grained detrital rocks of the adjacent uplands, whereas only illite is found in abundance in insoluble residue from karst area limestones. The source of much of the terra rossa, at least in south-central Indiana, is probably sediment derived from adjacent uplands.

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162. Visibility Reduction due to Power Plant Plumes. Ellen M. Leonard (Los Alamos Scientific Laboratory), Michael D. Williams (John Muir Institute) and Mona Wecksung (Los Alamos Scientific Laboratory).

A computerized procedure was used to illustrate the visual effects of power plant plumes on a clean landscape. The appearance of the plume is calculated using Mie and Rayleigh scattering along with light absorption in the plume. Skylight intensities are calculated via a program which solves the multi-layer radiative transport problem. The effect of different control technologies which result in differing particle size distributions is considered. Plumes from plants of varying sizes are also considered, as are variations in siting patterns. A number of different meteorological conditions are modeled. The image enhancement subroutine library developed at LASL was used to superimpose the plume data onto a digitized image of an unpolluted landscape, resulting in a computer generated color picture. The computer generated slides will be part of the presentation.

163. Pretreatment of Toxic Industrial Wastes - The Municipal Role. ALEXANDRA P. WRIGHT (Fred C. Hart Associates, Inc.)

Under the authorities of the Federal Water Pollution Control Act, the U.S. Environmental Protection Agency is implementing a regulatory program which requires industries discharging to municipal treatment works to pretreat toxic wastes which may interfere with the operation of the treatment plant, or pass through to receiving waters. Ultimately, this Federal program will be administered at the local level. The role of municipalities involves several steps: (1) completion of an industrial survey to determine the volume and constituents of wastes discharged by contributing industries; (2) establishment of a monitoring program; and (3) development of an effective enforcement program. The success of the pretreatment program is in large part dependent on the care exercised during the initial industrial survey, and on the level of cooperation achieved between industry and municipality.

164. Quality Management Of Irrigation Return Flows In Western United States. M.T. EL-ASHRY (Environmental Defense Fund, Denver, CO).

Irrigated agriculture is the largest water user in the U.S., accounting for 82% of all water consumption and 32% of all returned water. About 89% of all irrigated acreage is located in the West. Under present inefficient irrigation practices, less than half of the water delivered to farms is consumed by crops. Most of the unconsumed water returns back to the streams degraded in quality by salts, sediments, nutrients, and pesticides. The most serious water quality problem resulting from irrigation return flows in the West is salinity. Present damages from salinity in the Colorado River Basin are estimated at $53 million/year and are projected to $124 million/year by the year 2000 if control measures are not applied. Inefficient irrigation is mainly due to the low cost of water and to inaccurate estimates of irrigation frequency and amounts of water to apply relative to soil moisture conditions. Water losses and quantities of return flows can be reduced by improving irrigation efficiencies. Higher irrigation efficiencies for return flow quality management are technically feasible. They range from simple and inexpensive improvement in irrigation scheduling to the costly and sophisticated drip irrigation systems. However, their achievement will require changes in water laws to encourage water conservation, revised water pricing policies that discourage waste, and state land-use policies that discourage the bringing of highly saline soils into agricultural production.

165. Photochemical Transport Along the Western Shoreline of Lake Michigan HENRY S. COLE (on leave from Univ. of Wis.-Parkside; Office of Air Quality Planning & Standards, EPA)

During the latter half of August 1976, extensive parts of the midwest and northeastern U. S. experienced photochemical episodes. These were associated with large, slow-moving anticyclones. The region north of Chicago along the western shoreline of Lake Michigan experienced excessive daytime ozone levels on 5 consecutive days, August 18-22. A south-southwesterly gradient flow associated with the trailing edge of a nearly stationary high pressure system persisted. Lake breeze circulation developed during daylight hours on each day. Analysis of meteorological data and of ground level and aircraft ozone indicates that precursor emissions from the Chicago-Gary region contributed substantially to the ozone recorded in SE Wisconsin. Sources upwind of Chicago also appear to have contributed to ozone levels in Wisconsin. The lake breeze when superimposed on southerly flow tends to channel the flow of oxidants and precursors northward along the western shoreline of Lake Michigan. An O_3 transport layer is found several hundred meters over the shoreline and near-shore waters. Maximum ground-level ozone concentrations are found where ozone from this layer fumigates downward in the lake breeze flow. The lake breeze exerts a strong influence on spatial and temporal variation of ozone. Analysis of 1974 data indicates that meteorological conditions observed August 18-22, 1976 tend to occur during O_3 episodes in SE Wisconsin.

166. Resolution of the Elemental Concentration Pattern of Washington, D.C. Aerosols into Primary Source Components. GREGORY S. KOWALCZYK (University of Maryland, GLEN E. GORDON (University of Maryland).

Aerosol filter samples were collected at ten sampling sites during the summer of 1976 in the Washington, D.C. area and analyzed for 27 elements. Both individual samples and average concentrations were resolved into their component sources using a chemical-element balance method. The six component sources were coal, oil, and refuse combustion, soil, marine aerosols, and motor vehicle emissions. Cascade-impactor samples were also collected and analyzed in an attempt to perform separate resolutions of the large- and small-particle groups, the latter of which causes most of the health effects and decreased visibility attributed to particles. Concentrations of nonvolatile elements were predicted, on the average, to within a factor of two of observed concentrations, a considerable improvement over previous attempts. Among the elements considered, coal combustion is a major source of only two toxic elements, Se and As. Oil combustion accounts for most observed V and Ni, refuse incineration for Zn, Cd and Sb, and motor vehicles for Pb, Br, Cl and Ba.

167. Atmospheric Chemistry: Perturbations due to human activities. NIEN DAK SZE (Atmospheric and Environmental Research, Inc., Cambridge, Massachusetts 02139)

The effects of combustion, fluorocarbon release and fertilizer consumption on global atmospheric chemistry are investigated. Perturbations due to various anthropogenic activities may not be additive. Models are presented and compared with available observational data with emphasis on model validations. Uncertainties and major gaps in atmospheric chemistry are presented.

168. Chemistry of Venus' Atmosphere. WILLIAM H. SMYTH (Atmospheric and Environmental Research, Inc., Cambridge, Massachusetts 02139), NIEN DAK SZE (Atmospheric and Environmental Research, Inc., Cambridge, Massachusetts 02139)

Models describing the chemical and dynamical processes in Venus' atmosphere near and above the visible cloud tops are discussed. Emphasis is primarily placed on the stability of the CO_2 atmosphere involving catalytic chemistry of odd chlorine (Cl, Cl_2, HCl, ClO, ClOO). Importance of sulfur chemistry in the atmosphere will also be discussed.

169. Venus Thermosphere Analytic Modeling and Parameters Estimation. C. C. H. TANG (Jet Propulsion Laboratory, California Institute of Technology)

The Venus lower-atmosphere temperature and density profiles appear to be well-established by previous U.S. and Russian flights to Venus, but information on Venus upper-atmosphere remains scarce. The temperature profile of the upper thermosphere of an atmosphere has the characteristic that the rate of temperature change w.r.t. altitude at the top of the thermosphere approaches zero in order to reach a constant temperature in the exosphere. Analytic representations in the form of exponential functions raised to an integer power of the Dirac delta function are shown to approximate closely all the existing models of temperature profiles of the Venus thermosphere, including the NASA SP-8011, 1972 models and the Kumar 1977 model. The temperature profile modeling, coupled with appropriate prescriptions of the constituents number densities at the base of the thermosphere, facilitates (a) analytic evaluations of constituents number densities in the upper-atmosphere and (b) analytic derivations of the partials of the atmospheric parameters (thermosphere base and top temperatures, shape of the temperature profile, thermospheric base number densities of the constituents, and the height of the thermosphere). The estimation of these parameters could be accomplished by measuring the aerodynamic drag force on the Pioneer-Venus Orbiter through orbit determination processes and utilizing the analytic partials to extract the upper-atmosphere density profile from the drag force.

170. Fallout in Eastern Tennessee Following the Chinese Nuclear Tests of 1976-77.* T. W. OAKES, K. E. SHANK, and J. S. ELDRIDGE (Oak Ridge National Laboratory, Post Office Box X, Oak Ridge, Tennessee 37830)

Chinese nuclear weapons tests in the fall of 1976 and summer of 1977 resulted in increased fission-product inventories in the ambient environment. Following the three atmospheric detonations by the People's Republic of China on September 26, 1976, November 17, 1976, and September 17, 1977, the Environmental Surveillance and Evaluation program at Oak Ridge National Laboratory initiated daily sampling of air, precipitation, and milk in the eastern Tennessee area. Significant increases in radioactivity levels were detected in all three media following the first and third tests with little increase from the second. Iodine-131 levels as high as 130 pCi/ℓ and 150 pCi/ℓ were determined in milk following fallout from tests one and three, respectively. Analytical results are presented, and a discussion of the general philosophical approach to fallout monitoring, including action levels, will be given.

171. Characterization of Oil Shale Materials for Trace Elements and Organic Constituents. J. S. Fruchter and M. R. Petersen (Battelle Northwest, Richland, WA 99352)

Materials, including feedstocks, products, byproducts and effluents have been obtained from three different oil-shale retorting pilot plants. These materials have been analyzed for a number of trace elements, trace element species and organic constituents using a variety of modern instrumental techniques. Particular attention was paid to those elements and compounds of potential environmental significance. Measurements of the retort offgases were also made for a number of volatile compounds including Hg and As species and a number of organic constituents. Approximately 100 organic compounds were identified in the retort waters and product oils. Material balances were obtained for a number of trace elements in some retort runs. These analyses are part of an ongoing project to characterize products and effluents from oil shale retort pilot plants.

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172. Investigation of Electron Transfer in Biomolecules. M. J. POTASEK (Dept. of Physics, Princeton University, Princeton, N. J. 08540), J. J. HOPFIELD (Dept. of Physics, Princeton University, Princeton, N. J. 08540 and Bell Laboratories, Murray Hill, N.J. 07974).

Investigation of electron transfer by excitation modulation spectroscopy has led to recent evidence that the mechanism of electron transfer in certain biomolecules occurs by vibronically coupled electron tunneling at room temperature. Our initial experiments have tested the general constructs of this model in systems involving cytochromes.[1-3] Verification of the model comes from measurements of the theortically predicted change-transfer band. In the bound donor-acceptor complex of cytochrome c - cytochrome c perioxidase we have shown that electron transfer occurs by vibronically coupled electron tunneling. Our recent measurements directly establish the existence of a small ($f \sim 10^{-6}$) charge-transfer band in the near infrared ($\sim$ 1eV). The distance transferred is on the order of 8-11 Å between heme edges. One possible binding mechanism involves the lysines near the heme edge on cytochrome c and the proprionic acids on the cytochrome c perioxidase.

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2.) M. J. POTASEK and J. J. HOPFIELD, Proc. Nat'l. Acad. Sci. 74, 229 (1977).
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173. The Pincushion Grid "Illusion" and
A Spatial Frequency Model for Vision

ROGER D. McLEOD
(University of Lowell)

The diagonal lines generated by a pincushion grid or its complement, the Hermann grid, are physical and not an illusion. Furthermore, they are analytically predictable from their two-dimensional Fourier transforms, and the optically obtained Fourier transforms do have diagonal frequency components. The conclusion can be drawn that the eye does perform two-dimensional Fourier transforms of object space. A model for visual processes is proposed that vision is mediated by means of two quasi-monochromatic wavelength intervals at focal surfaces which are coincident with retinal cone and rod ends. Feature detail information is probably not transmitted to the visual cortex, but spatial frequency information probably is.

174. Detection and Analysis of a Thermoluminescence Effect in Insect Exoskeletons. DAVID E. FIELDS (Computer Sciences Division at Oak Ridge National Laboratory, Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee), ROBERT B. RANDALL (Physics Department, University of Louisville, Louisville, Kentucky), CHARLES E. BAUMAN III (Physics Department, Murray State University, Murray, Kentucky).

We have observed thermoluminescence emission from the irradiated exoskeletons of Cicada (Magicicada sp.) At our heating rate of approximately 60° C/min the peak light emission temperature was 183 ± 3° C. This effect corresponds to charge carrier trap parameters of $E_a = 0.82 \pm 0.04$ eV and $w_0 = 10^{9.1 \pm 0.5}$ sec^{-1}. Response to filtered γ radiation of 50 KV peak energy was on the order of 3.2×10^6 photons/Roentgen/gram. Insect exoskeletons are thus potentially useful as dosimeters.

175. Field Focusing NMR (FONAR) and the Formation of In Vivo Chemical Images in Humans. RAYMOND DAMADIAN, LAWRENCE MINKOFF, MICHAEL GOLDSMITH (State University of New York at Brooklyn).

The forced precessions of a nuclear magnetization under an r.f. driving field provide the basis for obtaining spatial resolution of the signal producing domains of a nuclear resonance sample. Sufficient coupling of the nuclear spins to the radiation field to produce a signal detectable by r.f. spectroscopy requires that the stringent Bohr frequency condition $h\nu = \frac{\mu H_o}{I}$ be met.

It therefore becomes possible to construct, with the aid of D.C. auxiliary coils, a small volume called the resonance aperture inside the applied static field of the magnetic resonance experiment. The correct value of H_o for the applied frequency is restricted to this aperture. The technique (R. Damadian, U.S. Patent 3,789,832, filed 17 March 1972) was developed to provide a method for non-surgically detecting the chemical abnormalities in the diseased organs of patients. (R. Damadian, Science 171, 1151 (1971)). The first NMR chemical images of the live human body will be presented. Cross-sectional color and black and white hydrogen images of the chest depicting the heart, lungs, descending aorta and body wall structures will be shown.

176. The Effect of Cadmium and Nickel on Calcium-45 Uptake by the Larvae of the Little Surf Clam, *Mulinia literalis* (Say). MING-SHAN HO and PAUL L. ZUBKOFF (Virginia Institute of Marine Science, Gloucester Point, Virginia 23062).

A sensitive and rapid bioassay system using calcium-45 uptake by bivalve larvae as indicator is established in this study. Various concentrations of cadmium and nickel are tested against a control without heavy metal. After the larvae are digested by HNO_3, the ^{45}Ca is measured by liquid scintillation and converted to absolute weight. Calcium uptake per larva versus elapsed time is linear up to 20 hours and then a plateau is attained in the control and cadmium test sets. A consistently low level of calcium uptake is observed throughout the experimental period for nickel. The calcium uptake rates in the linear portion of the curve are 3.495×10^{-5} and 8.935×10^{-5} μg calcium/larva/hour for the control and 2.0 ppm cadmium set, respectively. Contrary to expectation, cadmium stimulates the uptake of calcium. These phenomena are interpreted using models of enzyme kinetics: Nickel is hypothesized as an inhibitor of the enzyme system catalyzing Ca uptake and causes suppression. In contrast, cadmium inhibits a regulator of the calcium uptake system and thus permits more rapid calcium uptake to occur. At 2.0 ppm, a higher acute toxicity is observed for cadmium than for nickel.

177. Lipid Organization in Cholesterol-Phospholipid Bilayers. R. BRUCE MARTIN and PHILIP L. YEAGLE (Chemistry Department, University of Virginia, Charlottesville, Virginia 22901).

Three new structural models, which account for abrupt changes in physical properties observed at several molar concentrations of cholesterol in phospholipid bilayers, are described. Cholesterol monomers each surrounded by its own envelope of unshared acyl hydrocarbon chains of the phospholipid can accommodate 22% cholesterol. Cholesterol dimers each surrounded by its own envelope of unshared acyl hydrocarbon chains can accommodate 31% cholesterol. When surrounded by shared acyl hydrocarbon chains cholesterol dimers can accommodate about 47% cholesterol. At greater concentrations cholesterol aggregation occurs, the system is unstable, and cholesterol forms a separate phase.

178. An Investigation of the Reaction of Caffeine, Theophylline and Theobromine with Nitrous Acid and Nitrosonium

Tetrafluoroborate. HAROLD D. BANKS (University of Bridgeport), MARGARET BROOKS (University of Bridgeport).

Nitrosation of tertiary amines with HONO has been known for many years.[1] Because of the possibility of producing a carcinogen by N-nitrosation of caffeine in the stomach, the reaction of caffeine with HONO was studied under a variety of conditions. Theophylline and theobromine were studied for comparison. Ultraviolet spectrophotometry demonstrated that nitrosation did not occur for any xanthine studied. Nitrosonium tetrafluoroborate produces an N-nitroso derivative with theophylline, but not with caffeine or theobromine.

[1] P.A.S. Smith and R.N. Leoppky, J. Am. Chem.Soc., 89, 1147 (1967).

179. Radiolysis, Racemization and the Origin of Optical Activity. WILLIAM A. BONNER (Chemistry Department, Stanford University), RICHARD M. LEMMON (Lawrence Berkeley Laboratory, University of California).

20 Years ago Vester and coworkers suggested that the unique chirality of molecules in the biosphere might have originated abiotically as a result of asymmetric chemical effects induced by circularly polarized Bremsstrahlen produced from longitudinally polarized electrons emitted with parity violation during β-decay. More recently a number of investigators have attempted to verify this hypothesis experimentally, some reporting positive and some negative results. These reports, generally involving the attempted β-radiolysis of racemic amino acids, are reviewed briefly. In one study involving ^{14}C-labeled amino acids we found evidence suggesting that β-radiolysis might also engender racemization along with any potential asymmetric degradation. Accordingly, an investigation of such possible "radioracemization" was undertaken, exposing a number of solid or dissolved optically active amino acids to the radiation from a 3000 Ci ^{60}Co γ-ray source. γ-Ray doses which caused 55-68% radiolysis of solid amino acids typically engendered 2-5% racemization. Aqueous solutions of the sodium salts of amino acids which had undergone 53-66% radiolysis typically showed 5-11% racemization. Aqueous solutions of the corresponding hydrochloride salts, however, showed little or no racemization. In aqueous solution both percent degradation and racemization were linearly proportional to γ-ray dosage within the range employed ($1 - 36 \times 10^6$ rads). Implications of these observations for the origin of optical activity by the β-decay parity violation mechanism are noted.

180. Mechanisms for the Origin of Biomolecular Chirality via the Ionization of Chiral Molecules by Longitudinally Polarized Electrons. H. PIERRE NOYES (Stanford Linear Accelerator Center, Stanford University)*

The chiral electrons from ^{14}C acting on prebiological racemic mixtures of amino acids should leave an excess of L forms undestroyed and hence couple to biopoesis in a way which would account for the unique biomolecular chirality now observed. Bonner's experiments leave a 1% chiral excess when half the leucine sample is decomposed by 120 keV electrons with 20% longitudinal polarization—too large an effect to be accounted for by the spin-spin between the beam electron and the ejected molecular electron. However, the asymmetric, approximately dipolar, charge distribution of the molecule results in a spin-orbit coupling of the beam electron directly dependent on the electrostatic coulomb force. Our model for the chiral molecular electron mixes $\ell=1$ and $\ell=2$ states in such a way as to go asymptotically to an $\ell=1$ hydrogenic state and at short distance to an approximate representation of the effect of an electric dipole. The two chiral states we consider have $m_z = \pm 1$ relative to the dipole direction. Our initial state is the product of this wave function and the chiral scattering state of the beam electron relative to the undistorted charge distribution. Chiral ionization cross sections, averaged over the random directions of the dipoles in the sample can then be calculated to first order. Results will be compared with experiment.

* Work supported by the U. S. Department of Energy.

181. Gas Liquid Chromatographic Quantification of the Krebs Cycle Intermediates in the Mantle Tissue of the American Oyster, *Crassostrea virginica*. MING-SHAN HO and PAUL L. ZUBKOFF (Virginia Institute of Marine Science, Gloucester Point, Virginia 23062).

Seven Krebs cycle intermediates have been extracted from the mantle tissue of the American oyster, purified by Celite[R] and basic alumina column chromatography, derivatized by BF_3-methanol and quantified by gas-liquid chromatography. Complete separation of Krebs cycle methyl esters is achieved using temperature programming on a 1.8 m x 2 mm (i.d.) column packed with 10% EGSS-X on Gas-chrom P and peak areas are analyzed by an electronic integrator. Recoveries of standards from tissue are determined and quantification of each acid of the mantle tissue is done by using flame ionization detector response factor, recovery factor from tissue, and the internal standard, dimethyl adipate. Intermediates, expressed as μmole g^{-1} wet weight of mantle tissue are: citrate: 1.801; malate: 0.810; succinate: 0.204, α-ketoglutarate: 0.154; fumarate: 0.097; cis-aconitate: 0.006p and isocitrate: trace. With the exception of citrate, the Krebs cycle intermediates are present at levels comparable to those of guinea pig and rat. Contrary to a previous report, the succinate concentration of the oyster mantle is of the same order of magnitude as that of some mammals. The potential significance of the role of the high concentration of citrate is discussed with respect to the calcification process and heavy metal accumulation.

182-191 MATHEMATICAL BIOLOGY MON., 13 FEB., 3 P.M./ SA COLONIAL

182. Multiple impulse Solutions of a Nerve Equation. JOHN A. FEROE (Vassar College).

A piecewise linear partial differential equation which models the propagation of a nerve impulse along an axon is considered. As well as two previously investigated solutions, one representing a slow and the other a fast velocity solitary impulse traveling with fixed form, the existence of slow and fast multiple impulse solutions is exhibited. The local stability of these solutions is analyzed using a technique which identifies the number of unstable modes. In general fast impulses are stable and slow impulses unstable, however, both fast and slow multiple impulse solutions may exhibit a mode of instability which indicates a change in the spacing between two pulses.

183. A Problem in Mathematical Ecology. BEAN-SANGOH (Univ., of Western Australia).

184. Some Unresolved Mathematical Problems in Genetic Coding. MARTHA O. BERTMAN (Clarkson College), JOHN R. JUNGCK (Clarkson College).

While David Berlinski (On Systems Analysis, MIT Press, Cambridge, 1977) has contended that "biochemists have taken pleasure in the thought that decisive progress in the unraveling of the code was achieved in a way that owed nothing to mathematical methods", we will argue that the work of Gamow and others not only laid the basis for the biochemical solution of genetic coding, but that it, furthermore, led to other contributions of combinatorics, information theory, graph theory, group theory, and coding theory, as well as substantial contributions of statistics, which depthened our understanding of genetic coding and presented unresolved problems. We will present a tesseract graph of a 4x4 Klein group representation of the systematically degenerate genetic code (Bertman & Jungck, J. Bio. Ed., in press), a combinatoric analysis of possible genetic codes given certain evolutionary assumptions and a statistical justification for why certain amino acids are coded for by particular anticodon oligonucleotide sequences (Jungck, unpublished), notions on overlapping code limitations on synchronizability of coded sequences (e.g., 0X174), application of Shannon's first and second theorems of information theory to efficient coding, and finally to suggest some problems in error-detection and error-correction properties of the genetic code.

185. Computation of Periodic Traveling Wave Solutions to the Hodgkin-Huxley Equations. Preliminary report. ROBERT N. MILLER, JOHN RINZEL (The National Institutes of Health).

Nerve model equations typically possess periodic traveling wave solutions corresponding to repetitive firing in nerves. We have calculated a family of such solutions and determined the dependence of the propagation speed on firing frequency for the Hodgkin-Huxley nerve conduction equations at 6.3 degree centigrade. For each frequency below the maximum frequency of 147 Hz. we find two solutions, one fast and one slow. As frequency approaches zero, these solutions approach the fast and slow solitary pulse solutions (as previously calculated by other investigators). The speed of the fast wave is observed to drop from 12.3 meters/second for the solitary pulse to 4.6 m/sec. at maximum frequency.

Our calculations were done using a finite difference method rather than a shooting scheme. The wave profile, evaluated on a discrete grid over the period, along with the speed are determined as the solution to a set of simultaneous nonlinear equations. We believe our method to be widely applicable, and have used it to compute analogous solutions to the FitzHugh-Nagumo equations. Numerical experiments with the full set of partial differential equations have been consistent with the conjecture that the fast wavetrains are stable and the slow ones are not.

186. A Mathematical Analysis of Chemotherapy. RICHARD A. ALO (Lamar Univ.), WILLIAM TITUS

This paper analyzes several mathematical models of tumor growth. These models consist of groups of equations that represent the rules governing the movement of tumor cells through various stages of the cell cycle. The models allow one to predict the tumor population after a chemotherapy regimen. Thus, these models make it possible to predict the optimal doses, schedules and combinations of drugs for any tumor.

187. The Modified Makeham Model for Analysis of Survival Data in Transplant Studies. R. CLIFTON BAILEY (Naval Medical Research Institute).

After considering a number of survival models for the analysis of the nationwide kidney transplant histocompatibility study, we are proposing a modified Makeham model with a declining risk function. This model is specified in terms of three structural parameters easily associated with specific features of the risk function. Each of these structural parameters is resolved into component parameters associated with concomitant variables considered in the analysis. The expression for the expected survival provides a means of graphically displaying trends in the data. Some examples will illustrate the use of the model for analysis of kidney graft survival data.

188. Biological Cells and Computer Simulation of Their Holistic Functions. MILAN ZELENY (Columbia University)

Biological and social sciences have been often criticized for their exclusively reductionist approach to exploring the phenomena of their concern. Holistic functions of biological cells include autopoiesis, i.e. cell self-production and maintenance of its unity, cell differentiation, biological rhythms, aging cycle, and cellular division. Such holistic properties are independent of the reductionist concepts of information processors, coding mechanisms and gene regulators. They are mostly expressions of components' organization and interaction in a given environment of components. We present a number of printouts generated by APL-Autopoiesis Program. These graphical displays capture the dynamics of membrane formation, molecular transport, catalytic action, cancerous uncontrolled growth as well as crystalline retardation. Also, all of the above described holistic functions are being effectively simulated. Cell differentiation and evolution are similarly accounted for as being results of simple rules guiding the components' interaction.

189. Similarity Criteria and Modelling in Mammalian Hemodynamics. JOHN K-J. LI (University of Pennsylvania).

Pressure and flow waveforms in mammals at corresponding anatomic sites show similar characteristics. Fourier analysis of the respective waveforms at ascending aorta give frequency dependent input impedance and apparent phase velocity whose shapes are determined by variable amount of reflections. At low frequencies, the propagation wavelength is much longer than the system length, hence reflection is large. At high frequencies, the situation is reversed, reflection is minimal. The architectural features of the branching arterial tree and the distribution of wavelengths explain how wave reflections come about, as the proposed similarity criteria:

$$\lambda_{max} = c/f_1 \gg L \qquad \lambda_{min} = c/f_{15} \ll L$$
$$\Lambda_{max} = \lambda_{max}/L \gg 1 \qquad \Lambda_{min} = \lambda_{min}/L \ll 1$$

λ=wave length, L=characteristic length(aorta), c=wave velocity, f_n=nth harmonic(f_1=heart rate). The value of Λ_{max} is about 6.7 for horse, man, dog and cat. The historic windkessel model and the subsequent single uniform tube model of the branching arterial tree do not obey the criteria, so they falter. The similarity criteria is dimensionless, invariant of mammalian body size, and in line with modern pulse wave transmission theory. It is therefore, the necessary criteria for the modelling of the mammalian arterial trees.

190. A Metabolic Model for Astatine.* S. R. BERNARD (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830).

^{217}Astatine is a member of the ^{233}U decay series. Should a thorium fuel cycle be used then ^{233}U will be produced and astatine will be of concern in the internal dose problem of this chain. The radioactive half life (Tr) is only 20 milliseconds. Although it is not expected to be much of a problem, a metabolic model for astatine is needed for reliable dose estimation. The International Commission on Radiological Protection (ICRP) has a model derived from the data of Hamilton et al. (University of California Publications in Pharmacology, University of California Press, Berkely and Los Angeles, 1953) but this model is too abbreviated. In the present study these data of Hamilton et al., who injected ^{211}At (Tr = 7.5 hrs), were interpreted with a two compartment mammillary model. Equations have been obtained for which approximate retention in all the tissues sampled after a single intravenous injection. Retention in the total body is given by

$$R(t) = 0.8e^{-0.693t/30} + 0.2e^{-0.693t/0.2}, \quad t \leq 1 \text{ day}$$

The metabolic model used to represent retention in the central compartment and in the peripheral compartment will be presented and discussed.

191. The Combined Use of EEG Biofeedback and Computer Analysis as Tools for Studying Intracerebral Frequency Relationships. James H. Stramler, Jr. (University of Houston).

The present study introduces a new technique for studying frequency relationships between different structures within the brain. This study probably represents the next step beyond electrical stimulation in the evolution of brain study because it effectively eliminates the artifacts due to stimulation and provides the researcher with essentially a normal preparation. The author used an appetitive discrimination learning paradigm to effect an EEG biofeedback situation where cats were trained to produce 8 Hz and 40 Hz, according to randomly presented auditory discriminative stimuli. Electrodes were implanted in the medial thalamus, mesencephalic reticular, basal forebrain, frontal cortex, hippocampus, and visual cortex. The Center Median nucleus of the medial thalamus was the region conditioned in all animals. Effects of conditioning were observed in the other brain regions by computer analysis, which included computation of power, coherence, and phase spectra.

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*Research sponsored by ERDA under contract with UCC.

192-201 AGRICULTURE & FOOD — TUE., 14 FEB., 9 A.M./ SA COLONIAL

192. Nutrition Relative to Energy Costs for Some Convenience Foods.

Jean Mayer (Tufts University), Mary Rawitscher (University of Connecticut), Manjushri Prakash (Tufts University)

It is clear that convenience foods save much time in the kitchen. Not so clear is their effect on the consumer's nutrition, or energy consumption in terms of fossil fuel equivalents needed to prepare the food. Some convenience seafoods and bread are compared to similar foods prepared at home from basic ingredients. Energy consumption through the entire food chain is included - from agriculture or fishing through home use.

193. Concentrations of Trace Elements in Foodstuffs.*

T. W. OAKES, K. E. SHANK, C. E. EASTERLY, and L. R. QUINTANA (Oak Ridge National Laboratory, Post Office Box X, Oak Ridge, Tennessee 37830)

Forty-five types of food collected from commercial supermarkets have been analyzed for their radionuclidic and stable-element composition. A specific gamma-emitting isotope analysis was performed on each sample for ^{40}K, ^{60}Co, ^{95}Zr-Nb, ^{106}Ru, ^{125}Sb, ^{137}Cs, ^{226}Ra, and ^{232}Th. The concentration of the stable elements in each sample were determined using multielement neutron-activation analysis (Ag, Al, As, Au, Ba, Br, Ca, Ce, Cl, Co, Cr, Cs, Cu, Eu, Fe, Hf, I, K, La, Mg, Mn, Mo, Na, Rb, Sb, Sc, Se, Sr, Ta, Te, Th, Ti, U, V, Zn, Zr) and atomic absorption (Cd, Hg, Ni, Pb). Information on the composition of a typical diet is used to estimate the radiological dose to man and intake of stable elements subsequent to ingestion of these foodstuffs.

* Research sponsored by the U.S. Energy Research and Development Administration under contract with the Union Carbide Corporation.

194. Simulation Experiments Regarding Shortgrass Prairie Management--The Real-Life and Mathematical Models.

GEORGE M. VAN DYNE (Colorado State University).

This paper provides an overview of the field site and the simulation model characteristics for the shortgrass prairie being simulated in the papers of Joyce, Kautz, Victoria, and Williams. A large-scale, total-ecosystem, multiple-flow nonlinear difference equation model called ELM 1977 has been used in a series of modelling experiments to test management-oriented hypotheses. Field studies on the US International Biological Program's Grassland Biome study's Pawnee Site in northeastern Colorado from 1969 through 1974 provide validation data on driving variables, system state variables, and a few rate processes. The ELM 1977 model was constructed largely from information from the scientific literature and from laboratory rate process studies. The present modelling experiments test the consistency of these three sets of information about shortgrass prairie developed by largely independent groups of scientists--the simulation model, the field data, and the management-oriented hypotheses. There is good qualitative agreement, in general, among these three sets of information but the modelling experiments show lack of quantitative agreement in certain areas. Our knowledge of the abiotic components of the system appears best and that of heterotrophic components appears poorest (with the exception of large herbivores).

195. Long Term Grazing Impacts on the Shortgrass Prairie System.

BYRON KENNETH WILLIAMS (Colorado State University).

A series of experimental runs have been conducted using an ecosystem level simulation model parameterized for a shortgrass prairie to determine the long term grazing system responses to grazing intensities. The ELM 1977 model was designed to simulate the dynamics of grassland ecosystems of the United States under a variety of nutrient, moisture and grazing stresses. The model was adapted and tuned to simulate the shortgrass prairie of eastern Colorado, and a series of six-year simulation runs were executed to test the effects of different grazing strategies. In these experiments cattle were put on the system at day 120 (May 1) and later removed on day 300 (November 1). This pattern of stocking was repeated over the six-year simulations, and three different stocking rates were used. The simulation results indicate that the grassland ecosystem can tolerate moderate grazing strategies without dramatic system shifts, but that excessive grazing stress results in very large changes. The effects of increased grazing intensity generally include changes in species composition, primary and secondary productivity, and water-use efficiency. Heavy grazing shifts the ecosystem to a disclimax with lower biological activity, lower resilience in response to drought and grazing, and a shift in species composition to more grazing resistant species.

196. Impact of Grazing Intensity on Net Primary Productivity and Annual Gains.

JOSE S. VICTORIA (Colorado State University).

Sixteen ELM 1977 runs were made to compare impacts of different cattle grazing intensities on net primary production and animal gains under either good and poor initial conditions and good and poor weather conditions. An increase in grazing intensity does not necessarily lead to an initial increase of net primary production followed by a subsequent decrease in contrast to the *a priori* hypothesis. No simulation of net primary production due to light grazing was found. The extra-heavy grazing intensity regime leads to a diminished net production as originally hypothesized. An increase in grazing intensity decreases gains of individual animals in a nonlinear manner having less impact at first than at higher intensities. The increase in grazing intensity initially increases the gain followed by a decrease in gain per unit area for domestic animals. On a per animal basis, dietary quantity is shown to decrease slowly as the grazing intensity increases.

197. Effects of Season of Grazing and Type of Large Herbivore on a Simulated Shortgrass Prairie Ecosystem.

J. EDWARD KAUTZ (Colorado State University).

There was no major difference between grazing season or type of herbivore on the dynamics of soil water or community net primary productivity. There were slightly higher standing crops of cool-season grasses and forbs, and standing dead warm-season grasses were grazed earlier under yearlong grazing. The dynamics of live aboveground plant shoot categories was similar for cattle and bison treatments but different from sheep and pronghorn antelope treatments. Cattle production was about 3% greater under yearlong grazing than under seasonal grazing thus rejecting the *a priori* hypothesis that seasonal grazing would produce considerably higher yields. About 5% more herbage was grazed in contrast to 4% more produced under yearlong than under summer grazing. The cattle and bison used more warm-season grasses than did the sheep and pronghorn antelope which used more shrubs. Cattle grazed more forage than other large herbivores, 45% more than pronghorn antelope. Surprisingly, pronghorn antelope often had relatively high concentrations of live shoots of warm-season grasses in their diets. Their diet was also high in forbs. Secondary production ranks in decreasing order were cattle, bison, sheep, and pronghorn antelope. Herbage-to-gain conversions were 6% for cattle and 2% for pronghorn antelope.

198. A Six-Year Simulation of an Ungrazed Shortgrass Prairie.

LINDA A. JOYCE (Colorado State University).

Simulated dynamics of a shortgrass priaire ungrazed for six years are compared with field data. Weather records for 1969 through 1974 were used as driving variable input for this model. The 1969 initial conditions were estimated from available data. The annual precipitation ranged from 42 cm to 21 cm. Total annual precipitation as well as distribution during the year influenced primary production and root dynamics. Warm-season grass greatly responded to changes in the distribution of rainfall. Water was rapidly depleted from all soil depths in the root zone, but water accumulated in the lowest depth. The spring disappearance of dead plant material was extremely sensitive to precipitation events. The plant crown compartment increased slightly over the six years in all plant types, especially in warm-season grass. Grasshopper populations fluctuated with precipitation and vegetation patterns. Soil water simulation and data comparisons are reasonably good. The dynamics of cool-season grass, forbs, shrub and cactus resembled the data better than warm-season grass in years 1969-1971. Model output-data differences increased in 1972-1974. Data and simulation comparisons are also made with roots, grasshopper populations and small mammals. These similarities and differences are discussed in light of assumptions in the model and field data collection techniques.

199. Natural Resource Capital Stocks: Measurement and Significance for U.S. Agriculture.

GEORGE A. PAVELIS (U.S. Department of Agriculture).

Using perpetual inventory procedures, original time-series estimates (1900-1975) have been constructed for the gross and net stock of public and private fixed capital assets associated with agricultural irrigation, drainage and soil conservation activities in the United States. Annual investment outlays are from Federal construction and cost-sharing records or book-value changes, and also from cost-sharing and own-account facilities or equipment spending by farmers. Gross stocks in a given year are accumulated gross annual investments less abandonments or retirements to date. Gross stocks represent the cost of reproducing all existing assets at base-year (1972) prices. Net stocks are existing assets reduced in value by the amount by which they have depreciated. Net stocks are also proxies for values at which irrigation, drainage and conservation assets could be 'sold' in a market setting, and for the 'real' values of future productive services inherent in such assets. As of 1977 irrigation assets in the U.S. have a 'real' net value of about $13 billion (in 1972 dollars), increasing at $340 million/year. Drainage assets are valued at $5.5 billion, decreasing at $10 million/year. Conservation works are valued at $9.5 billion, falling by $80 million/year. The combined $28-billion total for all irrigation, drainage and conservation assets represents about 1/4 of all fixed non-land assets in agriculture and considerably exceeds the $20-billion estimated net value of all farm homes.

200. Pesticides, Pulpwood, and People: Controlling the Spruce Budworm (Choristoreura fumiferana, Clem.) in Northeastern North America.

LLOYD C. IRLAND (Maine Forest Service).

The Spruce Budworm now infests 150 million acres of spruce-fir forest in Northeastern North America. Aerial Spraying of insecticides has been the dominant control technique to date. In 1976, roughly 23 million acres were sprayed for budworm in Eastern Canada and Maine. Due to public and professional concern over the side effects of spraying, and to its rising cost, forest agencies and landowners are developing measures which can be used with spraying in integrated control programs. A major program of research and development is now getting under way. An important tool in this research will be computer simulation models of budworm - forest dynamics.

201. Response of Alfalfa and Soybeans to Preplant Seed Treatment with a Kelp Derived Growth Stimulant.

JERRY V. MAYEUX, Ph.D. (Dawn Corporation).

Scientists have often proposed exploiting the oceans as a means of meeting protein-nitrogen requirements for feeding the world. A fraction has been prepared from the marine alga, Ascophyllum nodosum, that has demonstrated potential for increasing nitrogen fixation and protein production by legume crops such as alfalfa, and the potential for six fold increase in nitrogen fixing capacity of soybeans. Preplant treatment of alfalfa seed with kelp fractions ranging from 30 mg/Kg to 130 mg/Kg gave up to three fold increases in nodulation, up to 50% increase in root mass, from 31 to 133% increase in aerial biomass and up to 122% increase in protein yields. Preplant treatment of soybean seeds has resulted in an increase in root mass and a sixfold increase in nodule formation. Actylene reduction experiments confirm these nodules to be active. These data suggest that it is possible to increase nitrogen fixation potential up to sixfold in legume crops and could mean that, by changes in cropping practices, it would be possible to produce most of the farmers' nitrogen fertilizer needs by adjusting the rotation of legume and non-legume crops, particularly where winter legumes can be grown.

202-211 ECOLOGY (TERRESTRIAL) — WED., 15 FEB., 9 A.M./ SA COLONIAL

202. A Biological Systems Approach to Wastewater Treatment Through Aquaculture Management.

DR. ALICE TANG JOKELA (San Diego State University), STEVEN SERFLING and DOMINIC MENDOLA (both of Solar Aqua Systems, Inc.).

By combining three technologies from three different basic fields, it is demonstrated that wastewater can be treated to reclaimable quality at greatly reduced capital cost, with much increased resources recovery. The three proven technologies are: 1. The aerated-lagoon treatment method in sanitary engineering; 2. Polyculture of floating aquatic plants, fish and shellfish for maximum-efficiency waste conversion; and 3. Solar greenhouses (when needed) for increased rate of production, and for seasonal reliability. In the San Diego area, over 90% reduction of BOD and suspended solids with over 80% N reduction can be achieved in a facility with 6 days retention time. Fish production is estimated at over 1500 lb. per acre per year.

203. Revegetation of Coal Mine Spoils and Autoallelopathy in *Kochia scoparia*.

M. K. WALI and L. R. IVERSON, (Project Reclamation, University of North Dakota, Grand Forks.)

Kochia scoparia, a member of Chenopodiaceae, is a common 'weed' that pioneers on freshly exposed spoils after surface mining for coal in the Northern Great Plains. Several years of field observations backed by quantified data on population estimates, density, growth form and biomass of the species, revealed an interesting phenomenon: from the first year of colonization by healthy and robust plants with low density per unit area, through decreased growth but increased density in the second or third year, it was completely replaced by other species in the third or fourth year. Studies were conducted to ascertain whether this phenomenon was solely due to competition from other species, or, was the process hastened by an autoallelopathic mechanism in the species. Controlled environment growth chamber experiments showed the latter phenomenon to be operative. When *Kochia*, *Agropyron trachycaulum* and *Melilotus officinalis* were grown in soil treated with *Kochia* leaves (7.5g/kg soil), it was found that the biomass of *Kochia* was reduced whereas that of the other species was unaffected. Treatment with *Kochia* leaves caused significant changes in the nutrient composition of soils and plants, including P/Mn and P/Zn ratios in plants. Field and laboratory studies, the probable mechanisms responsible for causing autotoxicity in the species, and their significance in revegetation and reclamation of spoil materials will be discussed.

204. Plant Responses to Nutrient Applications in Coal Mine Spoils of North Dakota. N.M. SAFAYA and M.K. WALI (Project Reclamation, University of North Dakota, Grand Forks.)

In addition to being sodic and/or saline in varying degrees, the coal mine spoils of western North Dakota exhibit several problems of plant nutrient availability. The dry calcareous nature of these spoils coupled with low soil temperatures during spring months favor reduced availability and slow uptake rates of many plant nutrients. However, since plants differ greatly in their response to various nutrient stresses, even marginal deficiencies may seriously limit the growth of nutrient-inefficient species or those with higher requirements. In growth-chamber experiments with a sodic mine spoil, significant growth response to Mn and Zn was obtained in alfalfa but not in oats or slender wheatgrass. The uptake of Mn by alfalfa was considerably low as compared to the other two species. N-fertilization increased the dry matter yields of oats and slender wheatgrass about 4 to 8 times, but of alfalfa only 46%. However, the Mn concentration in all the species was decreased. Fertilizing the spoil with Mn in addition to N, increased the yield response of alfalfa to 85% and with Mn+Zn to 99%. Generally low P availability in the spoils was recognized as the most limiting nutrient factor for both grasses and legumes. But P-fertilization invariably reduced the Zn content of plants. Thus the possibility of accentuating Mn and Zn deficiencies with NP-fertilization for some species was evident.

205. Environmental Protection Planning in Cape May, New Jersey. E. L. BOURODIMOS (Rutgers University), T. QUIRK, F. PANDULLO (Pandullo Quirk Associates, Wayne, NJ 07470).

Comprehensive biological, sanitary and oceanographic modeling investigations have been carried out at Cape, May, NJ in order to establish a regional environmental protection plan for the Cape May County Municipal Utilities Authority. The planning goals and constraints are: (i) effective and economic wastewater management; (ii) environmental quality and protection for the aquatic ecosystems and the wetlands; (iii) preservation of ecological stability and species diversity for the entire region; (iv) enhancing the visual environment, the aesthetic values and historical sites of the region along with minimal disruption of the present active land use, transportation and developable residential space; (v) strengthening of the social-economic infrastructure, the tourist industry and public health of the region. The methodology employed was based on (i) an environmental-biological assessment and ocean diffusion-dispersion investigations; (ii) topography, soil, groundwater, geology, hydrology engineering studies and proper selection of ocean outfall sites; (iii) air quality systems analysis consisting of studies in emissions, wind, atmospheric diffusion, chemical reactions, transport and receptor responses (corrosion, vegetation damage, health effects, etc.); (iv) sewage treatment and marine disposal design; (v) socio-economic analysis of natural, social and economic parameters in a new conceptual model of total resource management and environmental-ecological policy planning.

206. The Response of a Microcosm Matrix to Three Levels of Cadmium Stress. ROBERT F. GAUGUSH (Kent State University), ROBERT T. HEATH (Kent State University).

The response of a matrix of small laboratory ecosystems to cadmium stress was investigated. A microcosm matrix consisted of a 4 x 3 array with NO_3-N increasing on one axis and PO_4-P increasing on the other, so that each element had a different N:P ratio. N:P ratio ranged from 0.075 to 300. Biotic components of the microcosms were algae, protozoa, and bacteria. Cadmium chloride was added to three of four replicate matrices such that each of the elements had a concentration of 0, 1, 10, or 100 ppm Cd. Community productivity, respiration, chlorophylls, phaeophytin, and carotenoids were measured during succession (150 days), as were the PO_4-P and NO_3-N remaining available. Components of the biotic community were also monitored. The response of the 1 ppm Cd matrix was essentially unchanged from that of the control. Systems stressed with 10 ppm Cd showed diminished net photosynthetic rate, 0.75 of that in the control; rate of nutrient uptake was also reduced. Systems stressed with 100 ppm Cd exhibited no detectable metabolic activity and only very limited nutrient uptake. Within a given treatment matrix, the effects of Cd stress became more severe, as N:P atomic ratio increased.

207. Effect of Ecosystem Model Structure and Flow Magnitude on Cycling. JOHN T. FINN (Ecosystems Center, Marine Biological Laboratory, Woods Hole, Massachusetts 02543).

The amount of material cycling through an ecosystem model is a result of model structure and the magnitude of flows passing through that structure. For any one ecosystem model, these two causes are confounded. It is possible that the particular structure chosen to represent an ecosystem could determine amount cycled. I considered the extreme hypotheses that 1) flow magnitude alone determines cycling, and 2) model structure alone determines cycling. Cycling was measured as cycling index (CU), derived from flow analysis. To disprove hypothesis 1, different model structures with similar flow magnitudes should have different CI. Analysis of 79 hypothetical models showed hypothesis 1 to be incorrect. To disprove hypothesis 2, the same model structure with different flow magnitudes should have different CI. Different flow magnitudes for each of eleven model structures were analyzed. Except for structures with no loops, hypothesis 2 must also be rejected. Thus, neither structure nor flow magnitude alone determines CI. Therefore, CI of ecosystem models is due to a combination of model structure and flow magnitude.

208. Assessment of Biological Monitoring.* L. R. QUINTANA, T. W. OAKES, and K. E. SHANK (Oak Ridge National Laboratory, Post Office Box X, Oak Ridge, Tennessee 37830)

Past and present efforts in biological monitoring at the Oak Ridge National Laboratory are presented, along with a review of other similar programs at selected nuclear research and production facilities. Data on deer and fish sampling are given special emphasis since these animals are often eaten by man and, subsequently, can be used to quantify dietary intake of radionuclides. Other animals that are analyzed, because they inhabit a particular locale or are indicator organisms for specific radionuclides, are also discussed. An assessment is made correlating an animal sampling program to a particular type of nuclear facility.

*Research sponsored by the Department of Energy under contract with the Union Carbide Corporation.

209. Air Pollution in Human Health Damage Estimation and Control Policy Issues. BEN-CHIEH LIU (Midwest Research Institute).

210. Some Canadian Evidence of the Incidence of Urban Air Quality on Income Groups. PAOLO F. RICCI (University of Ottawa).

Spatial and temporal measures of Canadian urban air quality, AQI, are described by indices for suspended particulate matter, sulphur dioxide, nitrogen oxides, coefficient of haze, and oxidants. These indices are related to an index of income inequality, IEI, and average urban discretionary income, Y_d. These variables are utilized to form the model

$$IEI = a_0 \exp\left[a_1(\ln AQI - a_2)^2 + a_3(\ln Y_d - a_4)^2\right] + u_1 \qquad (1)$$

which, upon statistical estimation, describe static, income distributional characteristics of air quality. The static model, equation 1, provides spatial understanding of the incidence of air quality on income classes. The understanding is further enhanced by the dynamic model

$$C_t / Y_d = b_0 + b_1 Y_d + b_2 \ln AQS + b_4 (C_{t-1} / Y_d) + u_2 \qquad (2)$$

which relates consumption expenditures for polluting goods and services, C_t, to discretionary income, Y_d, the environmental index, AQS, and lagged expenditures. The policy implications of the findings are discussed in terms of what income group benefits from better air quality in Canadian cities.

211. The Galapagos Islands. In the Footsteps of Darwin SISTER DAMIAN M. SIMMONS (Loretto Heights College).

A trip to the Galapagos Islands provided the opportunity to observe first hand the same plant and animal species which led Charles Darwin to formulate his theory of Natural Selection. Ecuador maintains the Islands as a National Park, insuring preservation of native flora and fauna. In March 1977 several of the major islands were visited and the sights and sounds of the experience were captured on film, slides and tape, including birds, marine life, both land and marine iguana, sea lions, the famous Galapagos Tortoises, as well as the abundant plant life and unique lava formations.

212-221 ECOLOGY (MARINE) TUE., 14 FEB., 3 P.M./ SA COLONIAL

212. Organic Solute Uptake by Aquatic Microbial Communities: Use of a Four Pool Method to Show Interactions Among Solutes. LINDSAY W. WOOD, (New York State Department of Health).

Using methods which allow partition of total solute uptake by aquatic microbial communities into four pools, evidence is presented of several interactions of other solutes with respect to uptake of a test solute. The pools identified for the purpose of this study are the catabolic or CO_2 pool, the surficial pool (presumably at the cell surface), internal labile pool (presumably reasonably soluble intermediate substances) and an internal refractile pool (presumably large molecular weight materials which comprise the microbial cell.

Evidence is presented that glucose addition levels of 21 μg/liter can alter the surficial, CO_2 and internal pools of proline. Also, that glucose addition levels of 400 μg/liter or less can induce the operation of the two carbon metabolic pathways (Emden-Meyerhoff or Entner-Doudoroff). Additionally, evidence of a CO_2 feedback mechanism on amino acid consumption is presented for aspartic acid and proline.

213. Ecotone Vegetation of Coastal Wetlands of the Upper Great Lakes. CAROL A. JEFFERSON (Winona State University).

Wetlands contiguous and adjacent to navigable waters are included under Federal jurisdiction by the Water Quality Act. In order to reduce future litigation, studies were initiated to characterize by vegetation the boundaries of such wetlands. In 1977, the ecotones of 26 wetlands along the Upper Great Lakes were sampled for species presence and dominance. Both distinct communities and vegetational gradients were identified. Most common are communities dominated by Cornus, Salix, Alnus, Thuja, Fraxinus, Phalaris and Juncus, each with characteristic species assemblages and geographic distributions. Ecotones into swamp forests with perched water tables were variable and not well defined.

214. Detection and Ecology of Enteric Viruses in the Estuarine Environment. CHARLES P. GERBA, SAGAR M. GOYAL, and JOSEPH L. MELNICK (Baylor College of Medicine).

At the present time large quantities of domestic wastewater are being discharged into the coastal waters of the world. Present in these effluents are human pathogenic viruses which pose a potential health hazard. Recent advances in the methodology for the detection of enteric viruses in marine waters, sediment and shellfish have allowed for a greater understanding of the ecology of these microorganisms in coastal waters. The new methods have been applied to field studies conducted along the upper Texas coast during the last 5 years. The studies indicate that sediments and suspended matter play a major role in the survival and transport of enteric viruses in coastal waters and that conventional bacteriological indicators cannot be relied upon to give a true indication of the presence of a viral disease hazard. Secondary sewage effluents discharged into coastal areas were found to be a major source of enteric viruses in areas of residential development. Enteric viruses were also detected in shellfish and shellfish growing areas miles away from the nearest sewage discharge, indicating the prolonged survival of these microorganisms in coastal waters.

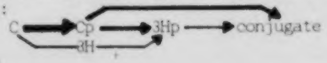
215. Oil Spill Hazards and the Salt Marshes of Port Valdez, Alaska, and Vicinity. JOHN H. CROW (Rutgers University, NCAS).

In 1974 and 1975, baseline locations were selected for intensive study in the salt marshes of Port Valdez and vicinity. The sites were chosen over a wide area to reflect the impact of oil transport activities and to enhance the likelihood of oil spill documentation. Vegetation and soil characteristics were emphasized. Seventeen Plant Community Complexes were identified, their habitats characterized, and utilized in evaluating susceptibility to oil spill damage. Marshes at Gold and Sawmill Creeks, both in Port Valdez, appear to be most vulnerable to major oil spill damage, but all the marshes studied were threatened to some degree. Oil spills associated with seasonal high tides or winter, when fresh water outflow is minimal, would increase the potential hazards to all the marshes.

216. Carbofuran Metabolism by the Bivalve *Elliptio* and Its Hemolymph. BARBARA HELEN ROBINSON and FRANK M. FISHER (Rice University).

The carbamate pesticide, carbofuran, is metabolized by the freshwater bivalve, *Elliptio*, a nontarget organism found in waterways in East Texas. Experiments were conducted to elucidate the pattern of metabolism, the major tissues involved, and the identity of primary metabolites, especially conjugated compounds. *In vivo* injection of ^{14}C-carbofuran (48h; 26°) revealed approximately half of the injected dose was recovered as a polar conjugate. *In vitro* studies using 10% tissue homogenates and hemolymph (4h;26°) indicate the most active tissue is the hemolymph. In organisms with an open circulatory system, such as bivalves, a metabolically active fluid would afford "a first line of defense" against many foreign compounds. Hemolymph was withdrawn from the adductor muscle sinuses, cellular components were concentrated via centrifugation, and cellular and plasma fractions were incubated with labeled carbofuran (C)(4-8h;26°). The majority of the radioactivity was recovered in the parent form

(C), and less than 10% was converted to a conjugated form. Often free and conjugated carbofuran phenol (Cp) and mostly free 3-hydroxycarbofuran phenol (3Hp) and/or 3-hydroxycarbofuran (3H) were detected. The form of the endogenous substrate is uncertain, but preliminary enzyme studies suggest a β-glucosidic linkage. A feasible pathway of carbofuran metabolism in *Elliptio* is:



217. Phosphate Release From Lakewater Organic Material. ROBERT T. HEATH (Kent State University) and DAVID A. FRANCKO (Kent State University).

Complex phosphorus compounds in lakewater differ according to the manner by which orthophosphate can be released from them. Low molecular weight phosphomonoesters and phosphodiesters release phosphate through the action of hydrolytic enzymes adaptively synthesized by planktonic organisms. Colloidal non-heme-iron-containing phosphorus compounds are resistant to hydrolytic enzymes. This heterodisperse high molecular weight class of compounds release orthophosphate upon irradiation with sunlight or with low doses of blue or ultraviolet light. The action spectrum of phosphate release and bound ferric ion reduction (Fe^{+3} to Fe^{+2}) are similar, suggesting a relationship between iron and the binding of phosphate to these compounds. Diurnal and seasonal fluctuations of these two classes of complex phosphorus compounds suggest that both may be significant in the dynamics of phosphorus in freshwater systems.

218. Biomass and Decomposition for 3 Macrophytes from a Brackish and Saltwater Tidal Marsh in New Jersey. BARRY R. FRASCO, RALPH E. GOOD, and RAYMOND WALKER (Rutgers University, Camden, N.J. 08102.

Biomass and N content during growth and decomposition phases were compared for Spartina alterniflora and S. patens (brackish and saltwater sites) and Peltandra virginica (brackish water site). While plant height and density of S. alterniflora showed site differences, average peak aboveground standing crop values were similar (725 & 780 g/m^2). Average peak standing crop values of S. patens differed at the brackish (349 g/m^2) and saltwater (577 g/m^2) sites. Peak standing crop for P. virginica (549 g/m^2) was reached 3 months prior to the Spartina species at both sites. The ratio of below- to aboveground net production averages 5:1. Percent N of the aboveground standing crop for P. virginica (2.1%) was twice the amount for the Spartina species. Only S. alterniflora showed an accumulation of N during the early part of the growing season. Preliminary data indicate that flux in N content of belowground material may be a function of dry weight biomass. P. virginica showed the most rapid rate of decomposition (80% in 40 days) followed by S. alterniflora (60% in 250 days) and S. patens (20% in 250 days). The differences can be attributed to flooding patterns and/or species differences in chemical composition. During decomposition, the % N increased continually for P. virginica; showed no change for S. patens; and increased gradually following an initial rapid decrease for S. alterni.

219. The Recurrence of Oxygen-Deficient Waters in a Shallow Marine Environment. HARRIS, ALVA (Nicholls State University) RAGAN, JAMES (Nicholls State University) GREEN, JOHN (Nicholls State University)

In June, 1973, a Nicholls State University Research Team discovered bottom waters containing little or no oxygen on the Louisiana Shelf 60 km west of the Mississippi River Delta. These waters comprised a layer 2-7 M thick ranging over contours of 6-33 M. Trawling on the normally productive bottom yielded few, if any, bottomfish or other highly mobile benthic forms. The condition persisted throughout the sampling year and covered between 27% (December) to 93% (July) of the study area. An exploratory cruise in July of 1973 revealed that oxygen deficient waters (0-2 ppm) covered at least 1000 square miles west of the Mississippi River Delta. During 1974 Nicholls State University investigators observed the phenomenon to be less widespread and of shorter duration, occurring mainly during the months of February through October. The diminishing importance of oxygen-deficient waters observed during the three year period was attended by a corresponding decline in Mississippi River discharge. The volume and composition of discharges with its predominantly westward flow is one of several factors that may be collectively responsible for conditions encountered exclusively west of the delta.

220. Chemical Water Quality and Land Use Patterns in the Upper Monongahela River Basin. E. C. KELLER, JR. (West Virginia University), J. MARK ROBINSON (West Virginia University) and MICHAEL KOON (Northern West Virginia Community College).

Chemical water quality evaluations were taken quarterly for two years in the Upper Monongahela River Basin in West Virginia. The area contains numerous strip and deep coal mines, some heavily forested areas, a small amount of agriculture, and several moderately sized cities. Some 13 chemical parameters were monitored at 85 sites throughout the upper basin.

By multivariate statistical analyses three factors were determined. The major factor (that with the largest weighting) was considered to represent dissolved materials, the second most important factor was considered to primarily represent acid drainage, and the third factor was considered to represent sewage input.

Within the upper basin, 6 rather distinct water quality areas were identified, over the four main tributaries examined. These 6 water quality areas were found to be generally associated with either the types of land drained or water uses.

221. Revegetation of Two Estuarine Wetlands Following Pipeline Construction in Southern Maryland. GREGORY J. ODEGARD (Columbia Gas System Service Corporation, Environmental Affairs Department).

A study was conducted to evaluate the effects of construction of a 36-inch diameter buried pipeline on a salt marsh and a fresh water wetland and to determine the rate of recovery of species composition and biomass to pre-construction conditions. Comparisons of pre-construction and post-construction vegetation samples were made. Aerial photography and sampling data indicated that vegetation was returning in the backfilled areas within one year after excavation of the wetlands. The construction of this pipeline resulted in no serious or long-term threat to the vegetational stability of these wetlands.

222-232 BOTANY (TERRESTRIAL) WED., 15 FEB., 3 P.M./ SA COLONIAL

222. A Portable Technique for Measuring Photosynthesis. C. Y. SULLIVAN (USDA-Agricultural Research Service), M. D. CLEGG (University of Nebraska) and J. M. BENNETT (University of Nebraska).

The technique involves the use of a small portable plexiglass chamber which has a small battery driven fan inside for air circulation. When the chamber is clamped on a plant leaf in sunlight for a few seconds, there is a rapid decrease in carbon dioxide if the plant is photosynthesizing. A small sample of air is taken with a syringe and needle from the chamber immediately after the chamber is clamped on the leaf and a second sample taken after about 15 seconds. The samples of air contained in the syringes, 5 to 10 ml, are analyzed for carbon dioxide concentration by injection into an infrared analyzer as described in a companion paper. Rates of photosynthesis are quickly calculated from differences in carbon dioxide concentrations between the two samples and leaf area covered by the chamber.
The system permits measuring plants at different locations without moving large amounts of equipment. The syringes with air samples contained can be transported many miles. The technique is being used for screening plant breeding materials for resistance to environmental stress, including effects of insects, insecticides, herbicides, diseases, and mineral nutrition on photosynthesis.

223. A Rapid Sensitive Technique for Measuring Carbon Dioxide Concentrations. MAX D. CLEGG (University of Nebraska), CHARLES Y. SULLIVAN (USDA,ARS), JERRY D. EASTIN (University of Nebraska).*

A method has been developed to rapidly measure CO_2 concentrations. The procedure involves injecting a gas sample into a flowing carrier gas which passes through an infrared CO_2 analyzer. The strip-chart recorded peak response is proportional to the CO_2 concentration. A resolution of better than 2 ul CO_2 per liter of gas was obtained. Seven to ten seconds is required for sample analysis once the sample is obtained. Photosynthesis, respiration and a decarboxylase enzyme have been measured using this technique. The efficiency of use of the infrared CO_2 analyzer. has been greatly increased.

*Research reported was conducted under project 12-69, Nebraska Agriculture Experiment Station and was partially supported by funds from the Agency for International Development, U.S. Department of State, Washington D.C. Contract Nos. AID/ta-c-1068.

224. Herbicide (2,4-D) Stress Effects on an Experimental Grassland Ecosystem. GARY W. BARRETT (Institute of Environmental Sciences and Department of Zoology, Miami University, Oxford, Ohio 45056).

The herbicide 2,4-D was applied to one of two comparable one-acre (0.4 ha) experimental grids on 8 July 1976. Herbicide application resulted in a "monoculture-type" plant community in the treated grid dominated by giant foxtail (Setaria faberii). Total protein for S. faberii decreased from approximately 15% early in the growing season (mid-June) to less than 1% in both grids by early October. Meadow voles (Microtus pennsylvanicus) restricted within these experimental plots reached a peak density of 116 animals/acre in early November in the control grid; the treated grid reached a peak density of only 68 voles/acre in early October. Male:female sex ratios were perturbed in favor of males in the treated grid (1.7:1.0) because of a reduced female survival rate in the treated grid. It appears that voles in the 2,4-D treated grid were subjected to food quality differences (e.g., protein deficiencies) in this "monoculture-type" community as compared to voles in the more diverse untreated habitat.

225. Gap Phase Dynamics in Virgin Mesic Forests. JAMES RUNKLE (Cornell University).

During the summerr of 1976 and 1977 I visited several virgin mesic forests in and near the Great Smoky Mts. Nat. Pk. of Tenn. and N.Car., the Tioneste Scenic and Natural Areas in Pa., and Hueston Woods St. Pk. in Ohio. Altogether I walked 97 line transects totalling some 24500 m recording the relative distances walked in and out of gaps created by the fall of one or a few canopy trees. For each of the 407 gaps so encountered I recorded the size (ranging from less than 25 to about 1500 m^2), age (from very recent to 28 years), environmental parameters, and (primarily woody) regeneration present. Using a combination of ordination, regression analysis, and other statistical techniques the data are being analyzed to determine vegetation characteristics (density, diversity, species composition, etc.) associated with each gap size-age class. Other characteristics of community structure and the biologies of individual species have been clarified.

226. Divergent Evolutionary Modes in the Chloridoid Grass Genus, CATHESTECUM. GARY J. PIERCE (Department of Biology, Niagara University, Niagara University, New York 14109)

Among grasses related to Bouteloua polyploidy is exceedingly common, and has been considered influential in the geographic expansion and adaptive radiation of these species.

Cathestecum, a small genus of this alliance. contains two subgenera. One fits the evolutionary pattern of the group with three of four species polyploid and with chromosome levels from diploid to octoploid. Here there is little differentiation between plants with different chromosome numbers. The remaining subgenus is exceptional among boutelouoid species, however, because all five taxa are diploid. As models of Darwinian-Mendelian evolution would predict, differences between species are marked and concomitant with geographic isolation. Where this spatial isolation is violated, two species, which are normally distinct, hybridize. Cathestecum is a microcosmic model in which the adaptive radiation of certain chloridoid grasses might be viewed.

227. A Taximetric Study in Potentilla. GARY R. WEIN (Department of Biology, Niagara University, Niagara University, New York 14109)

Rocky Mountain Floras diverge in their treatments of three distinct Potentillas collected in Northern New Mexico. One author indicates that P. hippiana and P. gracilis var. pulcherrima hybridize. Another identifies three separate species, P. hippiana, P. gracilis, and P. pulcherrima. Mass collections of these three plants were made at Philmont Scout Ranch in a dry meadow at 8500 feet elevation. Here appear three entities, one of which is morphologically intermediate. A taximetric study of these populations has been conducted to clarify their taxonomic relationships.

228. Photoreversal of Ethylene-induced Inhibition of Fern Spore Germination--An Action Spectrum.* R. W. FISHER (Virginia Commonwealth University), W. SHROPSHIRE, JR. (Smithsonian Radiation Biology Laboratory).

An action spectrum was constructed for the photoreversal of ethylene-induced inhibition of spore germination in the fern Onoclea sensibilis L. Preliminary broad band colored light studies were designed to determine which area of the spectrum was most effective in overcoming ethylene inhibition. Spores treated with 10 $\mu l/l$ ethylene and kept in complete darkness did not germinate. Red light treatment (590-950 nm, 100 $\mu W \cdot cm^{-2}$) resulted in 15% germination. Blue light treatment (380-530 nm, 100 $\mu W \cdot cm^{-2}$) resulted in only 1% germination. White light treatment (100 $\mu W \cdot cm^{-2}$) resulted in 17% germination. Red light, therefore, was the most effective portion of the spectrum and accounted for most of the effects of white light. This was true even if the ethylene concentration was reduced from 10 $\mu l/l$ to 1 $\mu l/l$. A detailed action spectrum was constructed using narrow band interference filters in the wavelength range from 350-800 nm. The action spectrum has only one major peak at 711 nm. Possible photoreceptors involved in this phenomenon will be discussed.

*Partially supported by the Smithsonian Fluid Research Fund

229.
The Primary Productivity of Two Temperate Zone Lawns
JOHN FALK (Smithsonian Institution)

A one year study of the primary productivity of two Maryland lawns was conducted during 1975/1976. The lawns differed in management intensity. Total net primary productivity was very similar for both lawns (6381 Kcal/m^2/yr versus 6814 Kcal/m^2/yr) with the more managed site higher. Management seemed to affect species diversity more than productivity. Maryland lawns exceeded California and Wisconsin lawns in productivity, but lawns represent the high extreme of temperate zone grassland primary productivity.

230. Inheritance of Albinism in Red Mangrove Rhisophora mangle L. Shirley W. Handler, Ph. D. (East Texas Baptist College).

Segregation for albino seedlings has been reported in temperate tree species and as a rare occurrence in tropical tree species. Inheritance of albinism may be due to a single gene or to modified genes. A low incidence of albino seedlings in Rhizophora mangle L. has been reported in a variety of diverse locations. Counts of segregating albino seedlings in Rhizophora mangle L. in South Florida and Puerto Rico show a 3:1 ratio. Controlled bagging experiments also show segregation. The data are consistent with albinism in Rhizophora mangle L. being due to a single Mendelian recessive gene and that selfing normally occurs. Albino segregants which contain no chlorophyll produce roots and leaves but cannot live long.

(Investigation reported by University of Miami Sea Grant Program)

231. Homeostasis of a Mixed Oak Ecosystem Following Clear Cutting. GARETH E. GILBERT (Ohio State University).

The mixed oak ecosystem of Neotoma--a wooded valley of south-central Ohio--was clear cut in≈1910. This perturbation did not, however, destroy the deep structure of the system which, due to the homeostatic mechanism of stump sprouting, is returning rapidly to steady state. Beginning in 1954, the density of woody stems ≥2.5 cm dbh was measured triennially and the resultant data enabled the derivation of the following equation which equates density of stems per 0.1 ha with time since 1954:

$$D(t) = 89.72 + 113.6e^{-.07782t}.$$

According to this equation, the mixed oak ecosystem of Neotoma will attain density steady state in≈2005, at which time the density of woody stems ≥ 2.5 cm dbh will approximate 900 stems/ha.

232. Understory Response to Tree Mortality in Different Patch Sizes. JOAN G. EHRENFELD (Rutgers University)

The response of the understory of a mixed hardwood forest to extensive tree mortality from gypsy moth defoliation was studied in order to ascertain whether the damage affects the composition and density of the understory vegetation. I hypothesized that the canopy openings would promote increases in the establishment of seedlings or in the crown cover of saplings and shrubs, or both, and that these responses would be greater in patches of high percentage canopy loss. The results were in striking contrast to expectation. Neither seedlings nor saplings showed significant increases in density, total crown cover per size class, or crown cover per individual, in either large or small gaps, compared to control plots. There was also no significant change in relative species composition between control plots and gaps of both sizes, indicating that no deflection of the natural successional change has been caused by the infestation. The results support recent suggestions that large and small disturbances have radically different effects on forest development. The data show that non-canopy tree and shrub growth play an important part in determining the response of a patch to disturbance. Therefore, the size of disturbance patches relative to the size of understory tree/shrub patches may be an important factor in defining "large" and "small" disturbances.

233-240 BOTANY (MARINE) THU., 16 FEB., 9 A.M./ SA COLONIAL

233. Biophotolysis with Heterocystous Blue-green Algae. JOHN R. BENEMANN and PATRICK C. HALLENBECK (Sanitary Engineering Research Laboratory, Univ. of Calif., Berkeley)

When heterocystous nitrogen-fixing blue-green algae are exposed to an atmosphere of inert gas such as argon, they simultaneously produce hydrogen and oxygen from water with light energy. This can be a sustained and catalytic reaction which can be demonstrated in the laboratory with efficiencies of over 1%. The mechanism of this biophotolysis reaction involves the nitrogense enzyme localized in the heterocyst cells which are cells specialized for nitrogen fixation. Both in vivo and in vitro experiments demonstrate that the hydrogenases, both uptake and reversible,found in these algae play only minor roles in the biophotolysis reaction. We have produced hydrogen outdoors using sunlight in a continuous experiment lasting almost four weeks. To maintain the cultures for such a long period, a small amount of N_2 (1%-2%) was added to argon in the gas phase. Several species of blue-green algae, including a strain of the thermophilic *Mastigocladus* have been tested in outdoor experiments. Practical application of this system requires algal strain selection and genetics,& development of a low-cost collector-converter system. Translating the 2-3% solar conversion efficiency that may be expected for such systems into a fuel value for the hydrogen collected gives an upper limit collector cost of at most 50¢/ft^2 of collector. A proposed design involves the use of thin tubular glas tubes (costing 12.5¢ for an 8 ft x 1.5" ⌀ section) arrayed in a flat-plate collector.

234. Nutrient Limited Growth of Algae in a Periodic Environment: the Phytoplankton

R.G.STROSS Dept. of Biology, SUNYA, Albany,N.Y. 12222

Tissue analysis, uptake kinetics, short and long-term nutrient bioassays may give conflicting or ambiguous interpretations. While density of phytoplankton and eutrophication correlate with concentration of a single nutrient, phosphate, its regulatory role is unconfirmed. That photosynthetic capacity (PC) is unaffected within a few hours following enrichment but significantly increased after more than 24 hours may reflect two solutions. One is a time specific shift-up in growth capacity. Reactive taxa are restricted to the net filterable fraction in nutrient poor, but not nutrient rich, lakes. Phosphate when increased by 0.1 micromolar in late afternoon or early evening, but not later in the night, increased PC by 175% or more of control when tested in the photophase of the day following; affected taxa include large diatoms and a colonial Green. Time specificity is consistent with circadian regulation of growth. Observations are consistent with models that invoke RNA synthesis with an identifiable block point determined by internal concentration of phosphate. However, some algae may carry surplus RNA, as in E. coli.

235. Further Studies on the Inhibition of Photosynthetic Electron Transport by a Toxin isolated from the alga Pandorina morum. G.M.L. PATTERSON, W.S. COHEN, D.O. HARRIS (School of Biological Sciences, University of Kentucky)

Treatment of isolated chloroplasts from either Pisum or Lemna with a toxin isolated from the colonial green flagellate Pandorina morum (Volvocales)[1] inhibits non-cyclic electron flow. Using various artificial electron donors and acceptors, it has been possible to localize the site of action of the toxin in the oxygen-evolving portion of the electron transport chain. Preliminary results indicate that mitochondrial electron transport (succinate oxidation) can also be inhibited. Preliminary studies on the chemical nature of the toxin will also be presented.

1. D.O. Harris and C.D. Caldwell: Possible Mode of Action of a Photosynthetic Inhibitor Produced by Pandorina morum. Arch. Microbiol. 95, 193-204 (1974).

236. Nickel and the Metabolism of Urea by Lemna paucicostata Strain 6746[*]. W.R. GORDON, S.S. SCHWEMMER AND W.S. HILLMAN (Biol. Dept., Brookhaven National Lab., Upton, N.Y. 11973).

With urea as the sole nitrogen source, the addition of Ni^{++} to axenic cultures of Lemna paucicostata (also called L. perpusilla) 6746 strongly increases both vegetative growth and respiration rate. In "Z" medium (Hillman 1975:Photochem. Photobiol. 21, 29)with 3×10^{-5}M EDTA, 29 mM (1%) sucrose and 10 mM urea, 5×10^{-5}M $NiSO_4$ more than doubles frond multiplication rate (MR) under both bright light and dim light-heterotrophic conditions. Under 15 min. of red light every 24 hours, Ni^{++} changes the daily pattern of CO_2 output from one having a single daily peak to one with two daily peaks resembling that given (op.cit.) by NH_4^+ or NO_3^- as sole nitrogen source. It also increases overall CO_2 output by as much as threefold on a fresh weight basis. Such effects of Ni^{++} are not evident on media containing nitrate as a sole nitrogen source.

Dixon et al. (1976:Science 191, 1144) have shown that Jackbean urease contains nickel, and Polacco (1976:Plant Physiol. 58, 350) observed a Ni^{++} promotion of soybean tissue culture growth on a medium containing urea. Our data provide additional support for the physiological relevance of the findings of Dixon et al. and represent the first such evidence obtained with an intact higher plant.

[*] Research carried out under the auspices of the U.S. Energy Research and Development Administration.

237. Morphological Changes Exhibited by *Pseudendoclonium* sp. in Response to Nitrogen Source and Concentration. MARILYN L. CAPPS (East Carolina University), A. M. WITHERSPOON (North Carolina State University).

Effects of nitrogen source and concentration on the morphology of *Pseudendoclonium* sp. were examined. Changes in form were observed by light microscopy and a scanning electron microscopy. Nitrogen sources used were nitrate-nitrogen, ammonium-nitrogen, casein, glycine, and urea. Concentration of nitrogen was varied in the Bold's Basal Medium from nitrogen-free to ten times the normal concentration. A fungal association was noted in casein and urea media which apparently facilitated use of these organic nitrogen sources. The fungus was dormant in inorganic media. Filament and palmella forms classically described in this genus were prominent in media which created nitrogen stress. Growth response of the alga to ammonium-nitrogen was sporadic.

238. Cell structure in chloromonadophycean algae. PETER HEYWOOD (Brown University, Providence, R.I. 02912).

The algal class Chloromonadophyceae consists of a few species of large biflagellate unicells which are relatively rare in occurrence. The ultrastructure of two of these organisms, Gonyostomum semen and Vacuolaria virescens, will be described. Serial sections have been used to demonstrate the relationship of the flagellar bases to each other and to the fibrous and microtubular roots. The anterior flagellum bears tubular flagellar hairs which are formed in the endoplasmic reticulum. The structure of the contractile vacuole and the method of osmoregulation will be described. Reconstruction from serial sections will be used to illustrate stages in the development of trichocysts (ejectosomes). The ultrastructure of chloroplasts and mitochondria will be compared to those occurring in other classes of algae.

239. **Nutrient Limited Growth of Algae in a Periodic Environment: the Cyclostat[*]. by I.J.GOTHAM(New York State Department of Health, Albany, N.Y.) and H.L. FRISCH(Department of Chemistry, S.U.N.Y. at Albany, Albany, N.Y.).**

Cyclostat[*] cultures provide an excellent means for investigation of nutrient limited physiology of cell growth and reproduction cycles in eucaryotic algae. We have developed both a conceptual and a theoretical model for periodic cyclostat growth. The model is considered to be functional since it is based on physiologically meaningful parameters. Furthermore, the model incorporates current concepts in cell biology and nutrient limited algal physiology. This presentation will consist of the general equations for nutrient limited cyclostat growth and the conceptual basis' from which they were formulated. Model output will also be compared with experimental data obtained from cyclostat cultures of Euglena gracilis .

[*] Continuous cultures maintained on light/dark cycles with a period of 24 hours.

240. Marsh, Mudflat, and Freshwater Diatoms in Marine Animals from Kachemak Bay, Alaska. THOMAS GLENN (Rutgers University, NCAS), JOHN H. CROW (Rutgers University, NCAS), JOHN D. KOPPEN (Rutgers University, NCAS).

From April through October 1976, the stomach contents of King Crabs (Paralithodes camtschatica), Tanner Crabs (Chionectes bairdii), Pink Shrimp (Pandalus borealis), Coonstripe Shrimp (P. hypsinotus), and Sidestripe Shrimp (Pandalopsis dispar) were monitored at two locations in Kachemak Bay. In the crabs, diatoms constituted only a trace of the stomach contents although their identification revealed a rich mixture of marsh-mudflat and marine taxa. Some of the taxa were characteristic of fresh water. Unlike the crabs, diatoms were a significant portion of the stomach contents of the shrimp. The majority of diatoms were associated with the marsh-mudflat areas of the Bay. Evidence of this sort serves to underscore even the subtle interactions between marsh-mudflat and marine habitats.

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241. Effects of Ecdysterone on Synthesis of Epidermal RNA's in the Crayfish. DONALD A. WHEELER (Biological Sciences, Kent State University).

Ecdysterone effects on 32P incorporation into RNA of epidermal cells from the crayfish Orconectes sanborni were examined throughout selected stages of the molting cycle (A, C_3-C_4, D_1'', D_1''', and D_2). The normal pattern of 32P incorporation into RNA was established from data obtained from the control animals. Two peaks of 32P incorporation into RNA were found to occur in the normal molting cycle of the non-ecdysterone treated animals. The first peak occurred in stage C_3-C_4 and the second was observed in stage D_2. The administration of ecdysterone enhanced 32P incorporation in all stages treated. The greatest effect of the hormone occurred in stage A. In this stage 32P incorporation into total RNA was 13 times greater in the treated animals than in the control animals. The total RNA was fractionated on a sucrose gradient (20-5%) into 3 components, component 1 being the heaviest and component 3, the lightest. All components were found to be increased over control levels in all stages treated by ecdysterone. The component most affected was the lightest RNA component, component 3. The elution profile of component 3 RNA from a CPG-10-170 column was slightly different from E. coli tRNA. Also, a chromatogram of a RNase T_2 digest of component 3 RNA was different from a rat liver tRNA digest. Speculation on the mechanism of action of ecdysterone in the molting cycle is presented.

242. The Role of Calcium in Cell Volume Regulation. D.J.L. McIVER (University of Western Ontario)

Many mammalian cells are able to regulate their volumes by a Na^+- and energy- dependent process, even when the Na^+, K^+ ATP'ase is 100% inhibited by ouabain.This process was investigated in guinea-pig renal cortex using the Ca^{2+} ionophore A-23187. In

K^+-free medium containing 1mM ouabain, A-23187 caused a significant ($p<0.01$) reduction in volume of renal cortical slices,due to a loss of NaCl and H_2O.The spaces occupied by ^3H-inulin or ^{14}C-polyethylene glycol 4000 did not change ($p>0.8$).The volume reduction was abolished by metabolic inhibition or by replacing extracellular Na^+ with Li^+ or choline.Additional pharmacological and ultrastructural studies suggest that A-23187 may have affected volume regulation by activating a Ca^{2+}-sensitive secretory vesicle mechanism.

243. A Primitive Bacterium Induced by Gentamicin. KOIBONG LI (York College of The C.U.N.Y.) LESLIE A. LEWIS (York College of The C.U.N.Y.)

A primitive bacterium was isolated after Salmonella typhimurium and Sal. heidelberg were treated with gentamicin at or above the minimal bactericidal concentration. The variant was distinctively different from the parent strain in its whole biosystem including colonial morphology, biochemical properties, antibiotic resistance, antigenic components, and in metabolism. The most significant feature was that the variant had a primitive metabolic pathway (anaerobiosis), and was not identifiable by modern biochemical methods. The variant was very stable under the anerobic conditions. However, it underwent aerobic adaptation by aeration to become aerobic and identifiable. The post adaptation strain was identical to the parent strain. Biochemical, genetic, and immunological evidence suggests that the variant represents a biosystem of a primitive bacterium. The action of gentamicin at the bactericidal level appears to block the aerobiosis (Krebs cycle and cytochrome system), and allows the expression of the variant form at higher concentration.

244. Iron and the Secretion of Hydroxamate Chelators by Euglena Chloroplasts. JOHN J. GAYNOR (Waksman Institute of Microbiology, Rutgers University, New Brunswick, NJ 08903).

Intact chloroplasts have been isolated from Euglena gracilis (z strain) cultured under iron-sufficient (40 µM) and iron-deficient (0.5 µM Fe) conditions. When incubated in a sorbitol/Tricine medium (0.33 M sorbitol, 50 mM Tricine/KOH, pH 8.4) in the light, it was found that the low-Fe chloroplasts secreted a hydroxamate-type chelator at a rate 40-fold faster than control chloroplasts (0.9 µmoles hydroxamate $H \cdot$ mg chlorophyll$^{-1} \cdot$ hr^{-1} for low-Fe chloroplasts). The chelator was identified by a colorimetric assay for bound hydroxylamine and a bioassay empolying Arthrobacter flavescens (JG-9). The chelator was isolated by Sephadex chromatography and determined to have a molecular weight of less than 1000. The secretion of the chelator was partially dependent on light and was linear for only a short period (ca. 20 min). In addition, this chelator was shown to complex iron. It is suggested that the secretion of the hydroxamate chelator functions in the scavenging of iron from the environment and is only activated under conditions of iron deprivation. Although there have been previous reports of hydroxamate chelator secretion by bacteria and blue-green algae, this is the first report of secretion by isolated chloroplasts. The exact molecular structure of the hydroxamate chelator remains unidentified.

245. A Tumor Factor that Modulates Macrophage Properties in Vitro. WALTER D. CANTAROW (Immunobiology Research Center, University of Wisconsin, Madison, Wisconsin), HOU TAK CHEUNG (Immunobiology Research Center, University of Wisconsin, Madison, Wisconsin), and G. SUNDHARADAS (Immunobiology Research Center, University of Wisconsin, Madison, Wisconsin)

Murine tumors possess a low molecular weight factor(s) which affects the migration, adherence, and spreading properties of peritoneal macrophages. The factor(s) enhances random migration and decreases the ability of the induced macrophages to adhere to substratum and spread. The appearance of this factor is unique to tumor and it has not been found in the normal tissues tested. The factor can be extracted from murine tumor cells grown either in vitro or in vivo and it has been found in all of the mouse tumors tested. It has a molecular weight of less than 3500 daltons as determined by dialysis, ultrafiltration and gel filtration and it exerts its migration enhancing activity directly on the macrophages. The migration enhancing activity of the extract is not affected by incubation at 100°C for 30 minutes, or prolonged exposure to ultraviolet light, gamma radiation or extreme acidic or basic conditions. It is also not inactivated by incubation with pronase or a mixture of phosphodiesterase, alkaline phosphatase, and pancreatic ribonuclease. The factor which affects the macrophage spreading is similarly not inactivated by exposure to ultraviolet light, gamma radiation, incubation at pH 2 or pH 11 or digestion with pronase.

246. The Behavior and Function of Lysosome-like Organelles during Reassembly of The Sea Urchin Embryo. S. HAMADA (Fordham University).

Disaggregated single cells from the gastrula stage of S. purpuratus were allowed to reassociate and form quasi-normal embryos in culture. Reformation was followed with time-lapse dark-field-phase microscopy and EM. A directed migration of lysosome-like vesicles appears to be the first expression of polarity within the epithelial cell. The lysosomes first migrate to the cell-cell interface, then to the basal cell margin and finally to the apical cell margin. Time-lapse observations show that they are clustered along the margins where active resorption and phagocytosis occur. In contrast to the migration of lysosomes in the epithelial cells, little or no specific migration of the vesicles within the mesenchyme cell occurs. While the lysosome in the epithelial cell originate from the fusion of saccules produced by the golgi body, in the mesenchyme cells, they appear to originate directly from the enlargement of the golgi's cisterna. Furthermore, little or no resorption occurs within the mesenchyme cell.

247. Biochemical and Antimicrobial Activities of Human Peripheral Lymphocytes. PAUL, B.B. (St.Margaret's Hospital for Women, SELVARAJ, R.J. (St. Margaret's Hospital for Women, SBARRA, A.J. (St. Margaret's Hospital for Women)

Lymphocytes (97%) have been isolated from freshly drawn human peripheral blood by modified Hypaque-Ficol method. These lymphocytes oxidize glucose, formate, alanine and guaiacol. Addition of particles significantly stimulates (6-7 fold) the production of $^{14}CO_2$ from glucose-1-^{14}C. Both the 20,000 xg supernatant and pellet of the lymphocyte homogenates indicate the presence of peroxidase and catalase as measured by quantitative biochemical assays. Thus, these fractions decarboxylate (peroxidative) L-alanine-1-^{14}C and oxidize guaiacol. The optimal H_2O_2 concentration for the peroxidase assays is $2x10^{-4}$M. The catalase activity of the fractions was quantitatively estimated by the perborate titration and spectrophotometric methods. The pellet, in the presence of Cl^- or I^- and H_2O_2 has bactericidal activity. The lymphocyte fractions differ from identically prepared PMN fractions with respect to the distribution of peroxidase and catalase. The effects of the inhibitors, cyanide, azide, 3-amino, 1-2-4 triazole and taurine on the bactericidal, peroxidase and catalase activities of the lymphocyte fractions indicate that the mechanisms of the bactericidal action are complex. Although the total peroxidase activity of the lymphocytes is less than that of the PMN, the lymphocyte enzyme is equally potent against E. coli when compared to equal guaiacol units of MPO.

248. Topography of Synaptic Membranes. S.P. Mahadik (N.Y. State Psychiatric Inst., Columbia Univ.), M.M. Rapport (N.Y. State Psychiatric Inst., Columbia Univ.).

Although synaptic membranes contain a very large number of protein and lipid components, only a relatively small number may be involved in synaptic connectivity and chemical transmission. A method to determine these is to isolate intact axon terminals (synaptosomes) and to label the molecules exposed on the outer surface by means of an impermeant reagent. We have carried out such experiments on synaptosomes from rat brain cortex, labeling glycoproteins and glycolipids in two steps: oxidation of galactose groups with galactose oxidase (the impermeant reagent), and reduction to the original structure with [^{3}H]-labeled sodium borohydride. The synaptic membranes were then isolated, highly purified, and the labeled molecules examined. The results showed that only a fraction (<1/5) of the molecules were labeled when compared with those that were present in the membrane. The predominant molecules exposed on the external surface of the synaptic membrane were glycopeptides with molecular weights (in thousands) of 96,72, 53,33,25, and 7.8-3.2 (range), and G_{M1} ganglioside. The molecular organization of the synaptosomal surface appears to be a closely-knit structure that readily prevents penetration by large molecules.

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249. Characterization and Analysis of Cell Surface Antigens of AKR/J Leukemic Mice Lymphocytes. ROBERT W. EISINGER (North Texas State University), BETTY A. HATTEN (North Texas State University).

This study is an analysis of cell surface proteins present on murine AKR/J leukemic spleen and thymus cells extracted with papain. Isolation of the individual proteins has been accomplished by column isoelectric focusing and preparative granulated gel electrofocusing. Molecular weights were determined by SDS disc gel electrophoresis and a combined PAGIF-SDS slab gel electrophoresis method. Antisera prepared to the individual proteins was used to test by Ouchterlony and immunoelectrophoresis to further characterize the protein samples from the different lymphocyte sources in regard to developmental stage of leukemia. These findings indicate an alteration of cell surface proteins in leukemic and pre-leukemic mice which are present in a congenic resistant strain C3H, as well as a control BALB/C strain. The significance of age and the sex of the mouse has been shown to have an effect on the number and amount of porteins present on the cell surface of the lymphocytes. Preliminary immunoelectron microscopy has been used to determine the presence of these surface antigens on lymphocytes during the onset and course of leukemia in mice.

250. *In vivo* synthesis and nucleotide modification of potato spindle tuber viroid. A. HADIDI (Plant Virology Lab, PPI, ARS, USDA, Beltsville, MD 20705) and J. M. KEITH (Lab. Biol. of Viruses, NIAID, NIH, Bethesda, MD 20014).

Potato spindle tuber viroid (PSTV) is an infectious single-stranded RNA which occurs in two forms: a linear RNA and a covalently closed circular RNA [McClements and Kaesberg (1977), Virology 76, 477; Owens *et al.* (1977), Proc. Nat. Acad. Sci. USA, in press]. Synthesis of PSTV was studied in leaves of systemically infected tomato plants, as measured by incorporation of ^{32}P into the two forms of PSTV. Experimental results suggested that linear PSTV arises *in vivo* by specific cleavage of circular PSTV, possibly by action of highly specific host endonuclease RNA processing enzyme(s). The nucleotide composition of the newly formed linear PSTV is the same as that of the circular form and contains 1-1.2 mole % modified nucleotides. Subsequently, the nucleotide composition of linear PSTV undergoes a slow and specific change which involves the formation of modified nucleotides. At the end of this alteration process, the majority of the linear PSTV molecules are resistant to RNase T_1, T_2, and A and nuclease P_1. Alkaline hydrolysis of these molecules and separation of nucleotides by paper electrophoresis at pH 3.5 revealed that more than 90% of the ^{32}P label migrated as 4 distinct spots ahead of Up. Pi was released from the eluate of each spot upon digestion with alkaline phosphatase. No change in the nucleotide composition of circular PSTV was observed. These results suggest that extensive modification of PSTV could provide a mechanism for protection of viroid RNA against ribonuclease degradation in the infected cells.

251. Carotenoids Protect Micrococcus roseus against Lethal Photodynamic Action. J. T. SINGER (University of Dayton, Dayton, Ohio 45469) and J. J. COONEY (University of Maryland, Solomons, Maryland 20688).

Lethal photodynamic action (PDA) involves death of cells when they are exposed to visible light and oxygen in the presence of a photosensitizer (PS). The PS may be an intracellular compound (endogenous PS) or an extracellular compound (exogenous PS) such as a dye. The carotenoid-containing bacterium Micrococcus roseus is killed by PDA in the presence of an exogenous PS, but it is resistant to PDA in the absence of an exogenous PS. Resistance could be due to a repair mechanism or to a photochemical buffering effect caused by the organism's carotenoid pigments. We have been unable to demonstrate a repair mechanism. Treatment of M. roseus with N'-methyl-N'-nitro-N'-nitrosoguanidine yielded two mutants which lacked colored carotenoids. When exposed to white light at 5,000 ft-c (5.4 X 10^4 lumens/m^2) in the presence of the exogenous PS toluidine blue, the mutants were killed more rapidly than the pigmented WT. When exposed at 12,000 ft-c (1.3 X 10^5 lumens/m^2) for as long as 8 h in the absence of dye, the WT was not killed, but the mutants were killed via PDA. Thus, carotenoids protect M. roseus against PDA sensitized by endogenous or exogenous compounds. In the absence of dye the WT was killed by PDA at high light intensities (32,000 ft-c, 3.5 X 10^5 lumens/m^2) indicating that cells have an endogenous PS. Under these conditions, too, the mutants were more sensitive than the WT.

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252. Sexual Selection in Bullfrogs, Rana catesbeiana. RICHARD D. HOWARD. (Bowling Green State University).

Variation in reproductive success within and between the sexes was investigated in bullfrogs, Rana catesbeiana, during 1975 and 1976 at the E. S. George Reserve of the University of Michigan. Number of successful matings per male ranged from 0 to 4 per year; number of matings per female ranged from 1 to 2 per year. The polygynous mating system of bullfrogs appeared to result from the differential abilities of older, larger males to control oviposition sites preferred by females. Younger males employed alternative mating strategies (male parasitism and opportunism) which appeared to reduce competition from larger territorial males and bypass female choice. Larger females produced larger clutches than smaller females and often produced an additional clutch in the same year. Patterns of female choice indicated that the ability of females to discriminate mate quality increased with female age. Absolute and relative fitness estimates were calculated for 38 males on the basis of number of matings, number of eggs fertilized, and number of offspring surviving to hatching. Larger, older males had much higher fitness estimates than smaller, younger males.

253. Cryptic Variation at the Alcohol Dehydrogenase (Adh) Locus in Drosophila melanogaster. GURBACHAN S. MIGLANI (Howard University), and JACK S. FRANKEL (Howard University).

Electrophoresis has proven to be a powerful tool in the analysis of genetic variation within and between populations. However, variant proteins with the same charge to mass ratio may go undetected by this technique. The present paper reports on the search for cryptic variants at the alcohol dehydrogenase (Adh) locus in populations of D. melanogaster. Isochromosomal lines, homozygous for the Adh I or Adh II allele, were produced from highland and lowland Mexican populations. Homozygosity of these lines was checked electrophoretically. Native ADH activity for each isochromosomal line was assayed spectrophotometrically at 30° C. This was compared with the activity of ADH subsequent to treatment with 0.7 M guanadine hydrochloride or

1.0 M urea for 40 seconds. The Adh II lines from the lowland populations showed approximately twice the resistance to denaturation than did the Adh II lines from the highland populations. The implications of these observations will be discussed.

254. A Universal Selective Pressure Affecting Avian Egg Recognition. STEPHEN I. ROTHSTEIN (University of California)

Passerines, and perhaps all birds, can be divided into two distinct groups on the basis of their responses to foreign eggs. In "rejecter species", nearly 100% of the individuals reject nonmimetic eggs, due ultimately to the selective pressures of brood parasitism. In "accepter species", nearly 100% of the individuals accept nonmimetic eggs. However, both rejecter and accepter species abandon clutches whose total mass falls below a certain size, even though accepter species are unresponsive to the appearance of individual eggs. Egg number is not critical to the abandonment response, rather the tactile or visual stimuli of the entire egg mass are vital. Apparently, selection favors abandoning a clutch that falls below a certain size because the potential reproductive pay-off does not warrant further investment of reproductive effort. The universality of this abandonment response exists because all birds on occasion lose some but not all of their eggs to accidental egg breakage, storm damage and predation.

255. Sexual Selection and the Evolution of Extravagant Characters. GERALD BORGIA (University of Michigan).

Several models for the evolution of what Fisher called "extravagant" characters are considered. Fisher suggested that highly developed, sex-specific ornamentation may commonly evolve by a process of runaway selection. Such a process requires continued preference by sexually active females for males who most prominently display a particular type of phenotypic character. The product of this mode of selection is development in males of exaggerated characters which are assumed to be maladaptive except for the gain in mating preference that they bring to their bearers. Specific problems exist with this and other models which attempt to describe such sex-related characters in males. It is concluded that for most cases existing models are unsuitable to explain the evolution of ornamentation important in mate selection.

The war-propaganda model is proposed. It suggests that extravagant characters function in signaling dominance of displaying males over sexual competitors. A presumed correlation of male ability to provide prominent displays and the quality of benefits a male provides form the basis for patterns of mate selection by females. The war-propaganda model is used as an aid in interpreting functions of courtship patterns in a wide variety of species.

256. Environmental Control of Mycelial Morphogenesis and Pigmentation in Schizophyllum commune. STANLEY DICK (Fitchburg State College, Fitchburg, Massachusetts)

A recessive gene, mnd, allows aerial mycelial protuberances, mounds, in haploid mycelia and homoallelic [mnd + mnd] dikaryotic mycelia; in heteroallelic [mnd^{+} + mnd] mycelia both mounds and fruit bodies may be produced. Temperature, light and nutrition, all known to affect fruiting morphogenesis, are reported here to control (a) mound formation and mound/fruit body ratios and (b) the phenoloxidases and melanoid pigments produced by mycelia in conjunction with these developmental phenomena. At 25° on a minimal medium under continuous light, mounds are formed on mnd, [mnd + mnd], and [mnd^{+} + mnd] mycelia, but fruit bodies and a red-brown pigment are produced only on the heteroallelic mycelia. At 25° in darkness the haploid and homoallelic dikaryotic mycelia again produce mounds but no pigment; heteroallelic mycelia exude pigments from the mounds despite the absence of fruit bodies. At 37°, both in light and darkness, fruit bodies are suppressed and mounds are poorly developed, if at all; pigmentation, however, is more pronounced, especially in homoallelic dikaryons. The high temperature effects on pigmentation and mound suppression are accentuated on a rich, complete medium. Mound and fruit body production, therefore, respond similarly in response to temperature, but independently in response to light. Phenoloxidases show a high temperature induction, but neither light nor aerial morphogenesis are necessary for their production and expression.

257.

Genetic and Demographic Interactions in Some Populations of Tribolium. A.M.MOFFA* and R.F.COSTANTINO (University of Rhode Island, Kingston).

Although the subject of recent theoretical investigation (Charlesworth, 1976) the relationship between the demographic and genetic structure of populations has received little experimental attention. The present study has focused on this relationship in 45 continuously growing cultures of Tribolium castaneum initiated with identical age structures but with different frequencies of the unsaturated fatty acid sensitive allele (cos). We have been concerned with 1) the nature of the genetic equilibrium at the cos locus, 2) the impact of different initial allele frequencies (P_o) on age structure and 3) the approach to and properties of the demographic equilibrium.---Total lifetime offspring production of the genotypes, calculated on the basis of life history data, predicts a stable genetic equilibrium that is not dependent on a stable age structure.---Demographic and genetic data were collected for 68 weeks. Those cultures initially segregating for the cos allele converged to an equilibrium allele frequency of 0.25 and a genotypic array composed of equal numbers of +/+ and +/cos individuals. The numbers of larvae, pupae and adults during the first 6 weeks were quadratic functions of P_o. Demographic equilibrium was realized by week 50. The overall demographic pattern during the 68 week study will be interpreted in terms of the interactions among the different life stages.

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258. Disruptive Speciation: Field Evidence in the Galápagos Land Snail Naesiotus. JOSEPH VAGVOLGYI (College of Staten Island, Staten Island, N.Y. 10301).

Earlier controversies on the mode of speciation have recently been revived by experiments and theoretical arguments claiming that speciation may result from disruptive selection. The present work reports on supporting distributional evidence. On 5 of the 6 largest and ecologically most diverse islands of the Galápagos Archipelago endemic species clusters have evolved. Species belonging to a cluster occur in different ecological zones, without intervening geographic barriers. Such distributional pattern conforms to the model of speciation based on disruptive selection. This interpretation is supported by the improbability of the alternative explanations such as the influence of geographic barriers in the past, secondary changes in the distributional pattern due to dispersal, extinction and reinvasion, multiple immigration, improper taxonomic ranking or improper assignment of taxonomic relationships. Hybridization may have contributed to, but ultimately is not responsible for, the clusters or the observed distributional pattern. Polyploidy may play a partial role, it has to be tested. - The land snails of some other archipelagos have similar taxonomic and distributional relationships, but the authors involved stopped short of invoking disruptive selection. Distributional patterns consistent with the disruptive model occur on continental areas, and patterns consistent with the geographic model occur on the Galápagos, too.

259. Cybernetic Theory of Natural Selection and Evolution. Thomas J Smith, Karl U. Smith (Univ. of Wisconsin-Madison).

This paper proposes a cybernetic theory of evolution, based on irrefutable evidence from all sectors of biology that every living organism is capable of self-governed, closed-loop control of organization and function on a continuous basis. The essence of this theory is the concept of feedback selection, which suggests that all living systems determine their own selection in evolution, as a function of their varying degrees of competency and sophistication in actively and permissively controlling their organization, their activity, and their environment (Smith & Smith, 1968). This control systems theory dismisses conventional environmental selection and competition doctrines as either naive or meaningless, and emphasizes instead the primary cybernetic role of living forms themselves in guiding their own evolution. The theory has particular significance for understanding human evolution---we believe that the unique abilities of man to sense, track, mark, and control time represent the distinguishing feedback selective factor in the evolution of the human species.

Smith, K. U. & Smith, T. J. Cybernetic Theory of Evolution. Madison, Wisconsin: University of Wisconsin Behavioral Cybernetics Laboratory, 1968.

260. Evolution of Colony-Specific Recognition in Ants and Other Eusocial Hymenoptera: A Model Based on Kin-Selection Theory. ALEX MINTZER (University of Michigan).

In many eusocial hymenoptera, conspecifics from different colonies are incompatible. Available evidence indicates that the discrimination of nestmates from other conspecifics is based on olfactory cues. However, the chemical nature and source of the differences allowing olfactory discrimination is poorly understood.

A model of colony odor based on kin- selection theory is proposed here. The genetic relatedness of individuals within and between colonies of social insects is a key consideration in this model, which attempts to explain selection for nestmate recognition. The predicted effects of polygyny and multiple insemination of queens are discussed. The importance of environmental heterogeneity and foraging behavior and the spatial distribution of conspecific colonies is evaluated in terms of the model.

261. The Limits of Sociobiology. J. Andre',(California State University, Sacramento).

Sociobiology is an exciting and fertile new view of behavior, social relationships and social institutions which promises great new insights into society. However, the more extreme hopes are unwarranted and misleading, for they would completely substitute physicalistic or evolutionary views for those more proper to human relationships (politics and morals). Given that the general thrust of sociobiology is correct, it is to be welcomed by all social scientists, but unwarranted extensions, in a positivistic, reductionistic manner, may create many problems and misunderstandings in our everyday lives as well as in our scientific understanding. There is a great deal of evidence from psychology that genetic contributions to personality variables and especially values and beliefs are far from being exhaustive. In fact, a particular position (psychopolitics) suggests that values and beliefs are the most important aspect of social behavior and that they are only weakly linked (as predispositions) to genetic factors. An examination of the proper perspective for sociobiology leads us into the thicket of over 2000 years of debate concerning political and moral features of a decent society, and encompasses not only human welfare in general, but also fundamental values (long associated with religion) and philosophical issues (i.e., the proper philosophy of science). A new approach in psychology (psychopolitics) suggests a framework with which we can put these issues into perspective.

262. Are Fitness and Survival Co-extensive Concepts. MATTHEW WITTEN(State University of New York at Buffalo, Department of Biophysical Sciences)

It is demonstrated that the concept of fitness is not co-extensive with the biological concept of survival. It can be demonstrated that there are cases where increase in the fitness of a biological population will decrease that populations chances of survival. The conclusion follows from a topological analysis of the simplest dynamical system $f_b(x) = bx(1-x)$.

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263. Histochemically-Detected Levels of Tubal and Uterine Norepinephrine in Various Endocrine States. ANNE HARRIS KATZ, (Fordham University at Lincoln Center)

Changes in norepinephrine(NE)fluorophore were studied in relation to time & location in the reproductive tract. Rabbits were killed at estrus,14h post coitum(PC), 24h PC. 84h PC & 7days PC. Oviducts & uteri(decidual & non-decidual sites) were excised, segmented, gassed in formaldehyde & mounted for fluorescence microscopy. The Whipple disc grid on a microscope ocular was used to quantify NE in the muscularis. There were significant differences($p < 0.005$)among tubal segments & times PC. Differences in decidual & non-decidual sites at 7 days PC were not significant. NE was lower in all tubal areas during ova transport(14-84h PC)than at estrus or implantation(7 days PC). However, during ova transport there were small elevations in NE at the ampullar-isthmic junction(AIJ)& in the isthmus at 14 & 24 PC, respectively. Decreases in isthmic NE coupled with increases in ampullar NE in the period from estrus to 14h PC were noted. All these effects may be part of a coordinated physiological system to maximize ova exposure to ampullar secretions, facilitate fertilization, aid in preventing polyspermy & help in synchronizing zygote transport to implantation sites. High tubal NE 7 days PC may serve to increase tonus in the entire oviduct & prevent reflux of fertilized. preimplanted ova from the uterus.

264. Social Influences on PMSG-induced Ovulation in Mice. Hsiu-su Ho (Institute for Behavioral Genetics, University of Colorado)

Immature female mice of inbred strains (SWR/J, C3H/2Ibg, C57BL/Ibg) were primed with a dose of pregnant mare serum gonadotropin (PMSG) and exposed to mice of different strains and sexes. The occurrence of ovulation and the number of ova released were found to be dependent on strain and sex of the stimulus animal. The response was greatest in SWR/J females exposed to SWR/J males. To investigate a possible mechanism by which the male's presence can facilitate PMSG-induced ovulation, blood samples were taken from SWR/J females at several time intervals after exposure to SWR/J males. Serum luteinizing hormone content was determined by radioimmunoassay.

265. Rapid, Male Induced Ovulation in the Mouse. ARTHUR K. CHAMPLIN (Colby College).

Work reported earlier has demonstrated that individually caged BALB/cWt female mice previously islolated from male odors have a high incidence (62%) of mating accompanied by ovulation on the first night after pairing with a stud male. These data suggest that factors associated with a male may induce ovulation. The studies reported here show that:

(1) Previous isolation from male odors is not a necessary condition for the occurrence of the first night peak in mating and ovulation. 48 BALB/cWt females housed individually in cages adjacent to males were paired with SJL/J males. 48% of the females mated and ovulated on the first night after pairing. This frequency of mating and ovulation is not significantly lower ($p > 0.05$) than the corresponding frequency in females isolated from male odors before pairing.

(2) Only visual, auditory and/or olfactory contact with a male is not sufficient to induce a high frequency of ovulation after pairing. An SJL/J male in a double wire mesh basket was introduced into the cages of each of 20 individually housed BALB/cWt females. 20 individually caged females served as controls. All females were examined during the next morning for the presence of freshly ovulated eggs. Only 4 of the 20 experimental animals and 3 of the 20 control females had ovulated.

266. The Effect of Protein Intake Level on Reproduction and Paedophagia in Laboratory Rats. R. R. ROTH (Zoology Dept., University of Western Ontario, London, Ont., Canada).

Groups of female rats were maintained on: a complete carbohydrate diet lacking protein(SS diet, group I), supplemented once(gr.II) or twice(gr.III) weekly for 24 hours with a complete protein diet lacking carbohydrate(HP diet). Gr.IV got daily both diets in separate containers(CS diet),whereas gr.V and VI got a mixture of both diets(CM diet,containing 22% protein). After 2 months the females were each paired with a male. The males were removed when pregnancy occurred or 30 days after pairing. Whereas gr.I-V were maintained on their respective diets throughout the experiment, gr.VI was changed to diet SS at the time of delivery and kept on it for 25 days. At weaning the pups were separated from their respective mothers. This sequence was repeated twice and the results were pooled. Results and conclusions: 1. Normal delivery, litter size and milk production/release were directly related to protein intake level. 2. The average number of pups produced per female was: gr.I-0; II-6; III-12; IV-18; V-30; VI-29. 3. Birthweight of young was independent of protein intake level. 4. The average survival rate of pups per mother was: gr.II-18%; III-66%; IV-89%; V-97%; VI-11%. 5. The average number of pups eaten per mother was: gr.II-69%; III-22%; IV and V-0%; VI-42%. 6. Paedophagia, probably, is an adaptive mechanism which ensures the survival of the species under conditions of low protein intake.

267.

Beaver (Castor canadensis) Colony Behavior and Fecundity Following Induced Sterility of an Adult. M. W. FLEMING* (Univ. Mass), R. P. BROOKS (Univ. Mass) and J. J. KENNELLY (Coop. Wildl. Res. Unit, Univ. Mass)

Although in most years breeding activity in a beaver colony is confined to an adult pair, sexually mature ♂ and ♀ progeny are present and will reproduce if one or both adults are removed. To assess behavior and reproduction in such progeny, one adult in each of 18 complete colonies (parents & progeny of the previous two years) was either surgically sterilized or sham-operated in Summer 1975. Sterility was induced by either tubal ligation (n=10; 5♂, 5♀) or castration (n=4; 2♂, 2♀); sham operations were performed in 4 colonies (2♂, 2♀). Behavioral and reproductive responses to these treatments were measured until August 1976. Reproduction (date, number of kits) was normal in sham-operated controls but 11 of 13 treated colonies did not reproduce; the 14th colony dispersed before parturition. Reproduction occurred in a ♂ ligated and ♀ castrated colony. In the former, a lactating sub-adult trapped in 1976 suggested sibling x sibling mating; in the latter, the adult ♀, treated in October, dispersed 2 weeks later and a pregnant 2-year-old was trapped in April. The results suggest progeny breeding behavior is affected by the adults' presence, not their breeding condition (castrate or ligate). Breeding inhibition is discussed with respect to 2-year-old dispersal, population density and beaver management.

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268. Plasma Steroid Levels in Relation to Ovulation and Vaginal Cytology During Postpartum Estrus in Norway Rats JAMES R. CONNOR, JR. (Wright State University), HARRY N. DAVIS, JR. (Wright State University).

Females of many mammalian species have long been known to have the capacity to conceive very rapidly after parturition. This shortens the interval between successive litters, and can thereby greatly increase the female's overall reproductive output. In rats, this ability is based upon a brief period of ovulation and behavioral receptivity occurring within the first 24 hours after the appearance of the first pup. Plasma levels of 17-β-Estradiol and progesterone were analyzed at 3, 6, 9, 12, 15, 18, 21, and 24 hours following delivery of the first pup by radioimmunoassay. Estradiol levels ranged from 130.35 pg/ml at 3 hrs. to a low of 5.35 pg/ml at 24 hrs. A secondary peak of 73.38 pg/ml was found at 21 hrs. Progesterone levels exhibited 2 peaks, 37.04 ng/ml at 12 hrs. and 23.01 ng/ml at 18 hrs. The intermediate levels ranged from 6.51 ng/ml to 12.65 ng/ml. Vaginal cytology and occurrence of ovulation were investigated to possibly correlate with the plasma steroid levels. Interestingly, ovulation occurred as early as 3 hrs. postpartum. Also, the females exhibited a "diestrus" smear throughout the 24 hr. period.

269. Oogenesis and Sperm-Egg Interactions in the Dog Trick, Dermacentor variabilis (Say). SULEIMAN A. SULEIMAN (Department of Biochemistry, University of Iowa)

Observations of oogenesis were made on adult females from the period before attachment to the host, during attachment, after full engorgement and shortly before oviposition. After attachment to the host, oocytes gradually enlarge until mature eggs are developed, a process which is completed few days after the female leaves the host. The events of oocyte maturation involve the emission of dense granular materials from the nucleus, formation of microvillar brush border projecting from the oolema, accumulation of yolk bodies in the ooplasm, and deposition of cuticle replacing the microvilli around the oolema. Insemination and sperm-egg interactions occur during oogenesis. The elongated spermatides, which were stored in the female seminal receptacle for 3-4 days, mature and become motile then travel into the oviducts to fertilize the oocytes in the ovary. The motile organelle of the spermatozoon is the first structure to contact the egg through a micropyle which is then sealed by the deposition of cuticle and thus fertilized eggs lack any access to spermatozoa. When mixing mature motile spermatozoa from a female seminal receptacle with oocytes or strips of ovary from the same or a different female, several spermatozoa move towards an oocyte. Each spermatozoon makes contact with the oocyte by the motile organelle and maintains contact for approximately 15 minutes. No penetration of mature eggs occur.

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270.

The Kirtland's Warbler-Cowbird - Habitat ("k") Interaction
DANIEL S. MCGEEN

The Kirtland's Warbler, an endangered species, recently underwent a 60% decline from 1961 to 1972. The Brown-headed Cowbird, a brood parasite, has been blamed. A model is presented which proved accurate for the years 1961-1972. It demonstrates that losses to cowbirds were part of a doomed surplus produced above the habitat's carrying capacity, for the "k" factor losses are subtracted after the cowbirds have taken their toll. A check on the model's inputs has been possible in the years since 1972. No reason to change any of them has yet appeared, though such is a possibility. An exquisitely elegant proof of my contention that the 12 year drop was due to a lessened "k" or carrying capacity, due to over-age habitat, was presented by proponents of predator control. They removed all adult cowbirds possible. Then with the consequent doubled intraspecific warbler fledgling pressures at surpassed "k" levels, a 23% crash occured in 1973, as counted in 1974. Aldo Leopold in 1933 and H. Mayfield in 1956 and I in 1972, 1973 and 1974 warned of just this probability before the crash count came in. The possibility of a wintering grounds involvement has been erased by the 1977 count. The excellent forest fire control since the 1920's has made the existence of this relict, specialist species precarious. Provision of more optimum habitat is all that is needed and is applauded. Predator control has been a failure, as predicted. The interaction is apparently a limit cycle. The carrying capacity is the ultimate limiting factor. Food is suspect.

271. Coloniality in terns: the role of social feeding. R.M. ERWIN (University of Massachusetts).

Aspects of foraging and colonial breeding in six Atlantic tern species were compared to test the "information-center" hypothesis. Inshore-feeders (Gull-billed and Least Terns) tended to have the smallest colonies, mid-range feeders (Common and Arctic Terns) were intermediate, while the 'distant' foraging Roseate and Royal Terns had the largest colonies. Consistencies were also found between group foraging tendency and foraging zone. Species foraging at greater distances feed in groups more readily than those limited to inshore feeding. Similar correlations were found among terns and alcids in Europe and British Columbia, respectively, suggesting that the phenomenon may be widespread. As well as providing a predator-deterrence advantage, colony size may also represent an adaptation for optimizing searching efficiency over a range of foraging areas where food is patchy and unpredictable in space and time.

Promiscuity among Red-winged Blackbirds (*Agelaius phoeniceus*)

T. A. ROBERTS (Coop. Wildl. Res. Unit, Univ. Mass).

272.

Fertile clutches were produced on the territories of nine vasectomized male red-winged blackbirds in 1976 and 1977. Concurrent histological evaluation of 13 breeding females indicated sperm persisted in the utero-vaginal glands for only a few days, suggesting fertile clutches resulted from matings outside of the polygynous territorial unit. This contradicts the general hypothesis that female choice of a male for pair bonding and genetic partnership are synonymous: females, at least female redwings, may have a wider range of behavioral options than previously believed. Most promiscuous matings occurred early in the spring, and the correlation of environmental variables with the incidence of promiscuity seems likely. Behavioral observations of sterile and control male territories revealed no measurable effects of vasectomy on either male territoriality or sexuality.

273. Patterns of Dispersal Distance in a Population of the Eastern Chipmunk, *Tamias striatus*. ETHAN P. ROBERTS (State University of New York - Purchase).*

A free-ranging population of the eastern chipmunk was trapped on a 13 ha. study area in southern Vermont for five seasons from Spring, 1969 through Spring, 1971. The dispersal distance of each chipmunk, whose first capture was on the central 1.44 ha. plot, was measured from its first capture lifetime to the center of its last five captures each season and from its site of first capture each season to the center of its last five captures during that season. Least-mean squares analysis of variance indicated no significant difference at the .05 level in the average distance of dispersal due to sex, season, or age while origin site was significant in one of three cases. The distributions of dispersal distances, grouped into six 20-m. intervals, were shown to be non-random, but these distributions did fit a negative binomial model.

*This work was performed as part of a doctoral thesis submitted to the Zoology Department of the University of Massachusetts-Amherst and was supervised by Dr. Dana P. Snyder.

274. Kin Selection and Individual Reproductive Strategies in Foundresses of the Social Paper Wasp, *Polistes fuscatus* (Hymenoptera: Vespidae). KATHARINE M. NOONAN (The University of Michigan).

Foundresses of the social paper wasp, *Polistes fuscatus*, frequently co-operate in founding colonies and in rearing both workers and reproductives. Through fighting and competitive egg-laying and egg-eating, one foundress within a social group establishes herself as the dominant and primary reproductive, or queen. Subordinate foundresses, although mated and potentially reproductive, are rendered effectively sterile, yet they remain as helpers at the nest for the rest of the season. Field observations and experiments indicate that: 1) the members of socially founded colonies are almost always sisters, individuals reared on the same parental nest the previous season; 2) foundresses discriminate between sisters and non-sisters in interactions during nest-founding; the grouping of sisters is, therefore, not simply an incidental effect of population viscosity; 3) socially founded colonies produce enough reproductives, compared to single-foundress colonies, for subordinate foundresses to increase their inclusive fitnesses by helping a sister-queen instead of attempting to found a colony alone. However, subordinates do not produce as many direct descendants as single foundresses; and 4) subordinates appear to strive within their social groups to lay and rear their own eggs, such striving reaching a maximum when reproductive brood is produced.

275. Reproductive Strategies in *Drosophila pachea*. MARGARET C. JEFFERSON (California State University, Los Angeles).

Experiments analyzing egg hatchability, sperm storage, effects of inbreeding, and mating preference suggest that the strategy for *D. pachea* females is to mate frequently, and mate with more than one male, preferably with males unrelated to the females. The absence of frequent multiple insemination leads to reduced sperm mobility and egg hatchability, which in turn leads to reduced fertility. The females usually contain some sperm in their spermathecae when they lay infertile eggs, but this sperm is largely immobile if an insemination occurred more than 24 hours earlier. It is suggested that the spermathecae must be continually packed with fresh sperm in order for efficient fertilization. The strategy of the male is to assure that his sperm are used in the fertilization of the eggs. The long copulation time and the coiled sperm may be adaptations of the male to protect his sperm.

276. Red Kangaroos and Desert Rain: A Herbivore's Dilemma. BOBBI S. LOW (University of Michigan).

Despite the dramatic impact of rain in the Central Australian desert, the occurrence of rain is very unpredictable, and there is strong evidence that it does not influence either density or dispersion of feeding red kangaroos. Community type ($p < .01$) and season ($p < .01$) were significant main effects influencing density, and community type was the only significant ($p < .001$) main effect on feeding dispersion. Comparison of kangaroo feeding dispersion just before and after rains showed that in three communities there were significant momentary changes in dispersion. Evidence from artificial "rains" produced by irrigation suggests that very patchy rains might cause marked transient changes in dispersion, but no evidence of sufficiently patchy natural rains was found to suggest that this is an important natural factor. Rain sometimes causes momentary shifts, but is not directly responsible in determining feeding density or dispersion. Direct effects relate principally to uncertainty of rainfall, rather than low amount of rain. There are secondary effects of aridity; e.g. scarcity of wooded cover. Wooded communities were used significantly ($p < .01$) more than predicted in all seasonal and rainfall conditions, regardless of forage composition; further, size of foraging groups was significantly ($p < .001$) larger in open areas, even when food was not clumped. These two facts suggest that predation pressure, both past and present, is considerably more important than previously supposed.

277. A Generalized Model of Arthropod Encounter Rate. JOSEPH DE VITA (Dept. Zool., Miami Univer., Oxford, Ohio), BARBARA WOLFE (Western Campus, Miami Univer., Oxford, Ohio).

A model is presented which is descriptive of encounter rate among microarthropods. Its structure stems directly from predictions of molecular collision rate in statistical mechanics, only that the system is collapsed to two dimensions. Collision rate (Z) is given as:

$$Z = \sigma \bar{v} n^2 k$$

where n is particle density, σ the "affective" particle size, $\bar{v}$ the most probable velocity, and k a constant of magnitude $\sqrt{2\pi}$. As a test of the model, encounter rate (the analog of collision rate) was determined at 16 densities for the beetle *Tribolium confusum* and the mite *Proctolaelaps* sp. For *T. confusum* and *Proctolaelaps* sp., respectively, the parameter k was calculated as $.83\sqrt{2\pi}$ and $1.41\sqrt{2\pi}$, indicating a good fit of predicted encounter rate to observed encounter rate. The significance and applicability of the model are discussed.

278. Rhythm and Other Laboratory Characters in a Taxonomic Comparison of Ants.

E. S. McCLUSKEY and S. A. SOONG (Loma Linda University).

Two species each of Pogonomyrmex and Veromessor, and one each of Formica and Myrmecocystus were studied simultaneously under controlled conditions. About 25 characters were examined, such as phase, level, amplitude, sinusoidality, and pattern of various position and activity rhythms. For most of these the F values for species comparisons are significant, many highly so. While the sample size is too small for a comparison of genera, the same characters give promise of being useful at the genus level also. These results add to previous field evidence for the biosystematic value of rhythm characters in ants.

279. Pheromonal Interactions in a Zooparasitic Nematode.

LEON W. BONE, H. H. SHOREY AND L. K. GASTON (Division of Toxicology and Physiology, Department of Entomology, University of California, Riverside, California 92521).*

Single, responding males of *Nippostrongylus brasiliensis* exhibited a dosage dependent movement toward a pheromone source that was derived from incubation or homogenization of female helminths in Tyrode's solution. Increases in female homogenate dosage beyond an optimum concentration resulted in reduced male attraction toward the pheromone source. Crowding of male *N. brasiliensis* prior to their exposure to female pheromone gradients diminished the male's responsiveness. On the other hand, crowding of female helminths had no effect on their release of pheromone. The locomotor responses of males exposed to various mixed male and female pheromone sources reaffirmed earlier suggestions of a pheromone feedback system in which males influence the attractiveness of the pheromone released from females.

*This investigation was supported in part by NIH Grant AI-14194.

280. Factorial Evaluation of Food-Sharing in Laboratory Colonies of the Imported Fire Ant, Solenopsis invicta.

DENNIS F. HOWARD, WALTER R. TSCHINKEL (Dept. of Biological Sciences, Florida State University, Tallahassee, Florida).

A multifactorial experiment was conducted to determine the concurrent influence of several factors on both the volume of radioactive liquid foods ingested by foragers and the subsequent trophallactic distribution of those foods within caste-standardized laboratory colonies of Solenopsis invicta. Factors tested were: a)type of food, b)duration of starvation preceding feeding, c)ambient temperature during foraging and food-exchange, and d)the time castes were sampled for radioactivity after introduction of food. This report emphasizes results associated with the food-type factor. The volume of food foraged was affected by food-type, since solutions of casein hydrolysate and sucrose were ingested overall at roughly five times the volume of soybean oil. A pronounced interaction between type of food and duration of starvation also influenced forager feeding. A striking contrast in food distribution patterns was related to the type of food being shared. Casein hydrolysate spread throughout the colony more rapidly and completely than other foods. It was also the only food that was shared in a greater proportion of larvae than workers and that reached the queen in a majority of colonies. In comparison to sucrose, oil was distributed among more workers and among approximately equal numbers of larvae. Possible explanations for differences in food-sharing patterns are discussed.

281. Employment of Kairomones to Manipulate Entomophagous Insects.

W. JOE LEWIS (USDA-ARS, Southern Grain Insects Res. Laboratory), DONALD A. NORDLUND, (USDA-ARS, Southern Grain Insects Res. Laboratory), RICHARD L. JONES (Univ. of Minnesota), and HARRY R. GROSS, JR. (USDA-ARS, Southern Grain Insects Res. Laboratory).

Kairomones mediate important steps in the host-finding behavior patterns of most entomophagous insects, and effective performance of entomophages in a particular area is dependent on the proper amount and distribution of these stimuli being present. Studies using the egg parasitoid Trichogramma spp. have demonstrated that kairomones can be used to improve the performance of parasitoids by improving their efficacy of search and by increasing their retention in the area. The various approaches for employment of these allelochemics in pest control programs will be explored.

282. Host and Prey Selection by Entomophagous Insects.

DONALD A. NORDLUND (USDA-ARS, Southern Grain Insects Res. Laboratory) and W. JOE LEWIS (USDA-ARS, Southern Grain Insects Res. Laboratory).

Host or prey selection behavior of most entomophagous insects is no longer viewed as random movement. We now realize that this behavior involves a series of fixed-action patterns brought about by the perception of various types of stimuli. These stimuli emanate from the environment and from the host or prey. Allelochemics of various types seem to be the most important kinds of stimuli. The host or prey selection process and the involvement of allelochemics in it will be discussed.

283. The Behavioral Structure of a Colony of Attine Ants (Atta cephalotes isthmicola).

BURTON A. WEISS and MINNIE L. HARRELL (Drexel University, Philadelphia 19104)

A colony of Attine ants (Atta cephalotes isthmicola) was collected in the field in Panama and established in layers of 40 ml interconnected boxes joined to a large screened chamber simulating the structure of an ant nest and outside foraging area. Marked workers were observed and their behavior revealed the complex caste, chamber, and age specialization of the colony. Quiescent individual periods and behavioral change because of temperature variation where also observed.

284. Maternal Environment and the Variability of the Light Requirement for Termination of the Embryonic Diapause in Daphnia pulex.

JAMES W. SUTHERLAND and RAYMOND G. STROSS (State University of New York at Albany).

Previous studies with diapausing embryos of different seasonal patterns of Daphnia pulex have shown that light may be required for diapause termination (Stross, 1965, 1966, 1969b). The present study was carried out to determine whether the role of light in diapause termination is influenced by the maternal environment of the embryos. Laboratory cultures of the dicycle and spring monocycle of D. pulex were maintained under controlled temperatures and daylengths. Diapausing embryos were collected from the cultures and incubated under temperatures and daylengths which represent conditions in the natural environment to which the embryos would be exposed.

The diapause interval of both seasonal patterns consists of a refractory phase and a sensitive phase. The two patterns differed in their requirements for completion of the sensitive phase and in the influence of the maternal environment on the requirements for diapause termination. In the dicycle, temperature of the maternal environment determined whether light was required for activation at 3.0°C. The effect of maternal environment on diapause termination requirements is demonstrated in this arthropod species only. Some diapausing embryos of the spring monocycle were activated in constant dark at 3.0°C regardless of the treatments received by the mother.

285. Gypsy Moth Mixed-Function Oxidases: Effects of Rearing Medium on Enzyme Levels.

S. AHMAD AND A. J. FORGASH* (Dept. of Entomol. and Econ. Zool., Cook Coll., Rutgers Univ., New Brunswick, N. J. 08903)

Fifth-instar gypsy moth Lymantria dispar L. larvae reared on a semi-defined wheat germ diet show significantly ($P < .001$) higher mixed-function oxidase (MFO) activity than oak leaf-reared larvae. Also, the diet-reared larvae, unlike

the oak-reared ones, exhibit a pre-ecdysial depression in MFO activity that parallels the pre-ecdysial cessation of feeding. The elevated MFO activity presumably results from certain inducers present in the artificial diet; these are either absent or occur at low levels in the oak leaves. These findings have important implications with respect to comparative insect toxicology; e.g. assessment of MFO levels in different species, MFO induction studies and insecticide tolerance and metabolism.

*Supported by McIntire-Stennis Funds and Regional Funds under Project NE-84. Contribution from New Jersey Agricultural Experiment Station.

286. Mathematical and Biological Analyses of Wing Growth in Drosophila. LOIS A. ABBOTT (Univ. of Colorado-Boulder)

Wing growth in Drosophila can be modeled as the growth of a two-dimensional hexagonal array by binary division of its cells under the constraint that cell lineages remain contiguous and spatially restricted (compartmentalized). Several models based on geometry and L-systems were tested by computer simulation and biologically by observing the distribution of the seven possible four-cell clone configurations which can arise in an hexagonal array from division of a pair of sister cells. This fit very closely ($\chi^2=1.186$, $P=.95$) the prediction of a model based on pairs in which displacement of a neighbor selected at random provides space for the new daughter cell. Such a random model predicts some clone splitting which was then observed. In addition, small enclaves of non-clonal cells were seen near the borders of large clones even though such islands are not observed deep within clones. It appears that cells isolated from their own lineages fail to grow and cell death to eliminate isolated non-clonal cells is implicated. The resultant "pruning" along the clone borders acts to maintain clonal integrity and can account for the regularity of compartment boundaries.

287.
Resource Partitioning and Mimicry in Passion Vine Butterflies.

Woodruff W. Benson (Universidade Estadual de Campinas, Brazil)*

Passion vine butterflies (Heliconiinae) are typically Müllerian mimics and serve as models for Batesian mimics. However, in any given locality several distinct mimicry rings exist side by side, leading to the question: If Müllerian mimicry is adaptive, why have not all species converged to the same color-pattern? I shall attempt to answer this question by showing that 1) mimicry rings are habitat specific, suggesting that gross color-pattern is selected for optimal information transfer under specific conditions, 2) distantly related species tend to form the bulk of the cases of mutual mimicry and rarely do sister species become good mimics of one another, 3) closely related heliconians have qualitatively similar resource requirements, and 4) competitive interactions between these tend to cause habitat shifts resulting in their "capture" by divergent mimicry rings. These mechanisms may contribute to a general theory for explaining the structure of herbivorous insect guilds.

*Research supported by NSF, CNPq and CPEG-UFRJ.

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288. Photoperiod and The Distribution of White Blood Cells in Newts. MIRIAM F. BENNETT (Colby College).

Adult Notophthalmus viridescens, maintained at a constant temperature, were exposed to LL or to 12L:12D for eight successive days. Control newts lived at the same constant temperature and in DD. On the ninth day, all animals were sacrificed, and blood smears of each were prepared. Differential counts of the leukocytes of the groups were compared. In newts living in LL, the neutrophils increased 65 per cent and the lymphocytes decreased 16 per cent relative to those of the animals in DD. The differences are statistically significant ($p<0.001$), and typical of Notophthalmus exposed to osmotic stress or treated with ACTH or hydrocortisone. For newts exposed to 12L:12D, the per cent distributions of the white blood cells were essentially the same as in the control animals. These results suggest that treatment with continuous light is stressful to Notophthalmus, whereas exposure to 12L:12D for eight days is not.

289. Mesoscale Plankton Patches In the North West Atlantic Ocean.

John A. Fornshell (United States Coast Guard Oceanographic Unit)

Plankton samples were collected in the North West Atlantic on the Grand Banks of Newfoundland in August of 1976 and on Flemish Cap in March of 1977. The samples were taken using a Hardy Continuous Plankton Recorder, towed at a depth of five fathoms, 9.23m. by the CGC DALLAS and CGC GALLATIN respectively. On the Grand Banks the following species were found Ceratium arcticum, C. longipes, C. lineatum, C. macroceros, C. fusus, C. tripos and Ceratium sp. Other microplankton found in the samples included Radiolarida, Globigerina humilis, Tiniopsis cylindrica and Tintiniopsis sp. In the samples from Flemish Cap only a single species of diatom was found in small numbers. The paucity of individuals in these samples is most probably related to the season of the survey, winter. In the samples taken on the Grand Banks, the population density was inversely related to the depth of the water. There was a second scale of variability in the population density with a length on the order of ten nautical miles. The plankton tow on the Grand Banks was made parallel to the North-South axis of the Labrador Current. This smaller scale of variability may reflect a meandering in the Labrador Current.

290. Ageing of Tropical Fishes by means of Otoliths. GIORGIO PANNELLA (University of Puerto Rico), OSCAR MIRANDA BRANDT (University of Chile).

Age determination in tropical fishes is difficult for several reasons such as that spawning seasons are long and spread through the year and growth checks are not formed annually or regularly. Systematic collections at regular time intervals of several common species in Puerto Rican water have shown that age uncertainties could be solved by the use of growth patterns in the otoliths.

The study of several hundred otoliths justifies the following conclusions:

1. Although less marked, otolith zones are always present in otoliths.
2. The time represented in the zones is constant in each population and in each species and is related to both environmental and physiological events such as peaks of primary production, spawning, migrations.
3. Otolith deposition is not continuous but hiatuses in sequences of increments are easily identified, and the missing time can be calculated.
4. Within the zones, bands, representing time intervals ranging from 14 to 30 days, are present and may be used to determine with great accuracy the chronological meaning of the zones and, ultimately, the age of the fish.

291. Directional Orientation of Blue Crabs, *Callinectes sapidus* Rathbun: Escape Response and Influence of Wave Direction and Beach Slope. ROBERT TERUMI NISHIMOTO and WILLIAM F. HERRNKIND (Florida State University).

Blue crabs (*Callinectes sapidus*) which invade the upper intertidal at high tide exhibit rapid, directed locomotory movements (i.e., escape response) significantly oriented offshore. Wave direction and beach slope are conservative features of the intertidal indicating offshore and can be used by blue crabs as orientation cues. Non-injurously blinded crabs oriented significantly downslope or into the wave surge approach in experimental field and laboratory test arenas.

Orientation acuity increased with a change in wave velocity from 2.0 to 13.5 cm/sec. Experiments in a wave test tank suggest wave displacement and not velocity as the important component of the hydrodynamic cue imparting directional information to blue crabs. Experiments using slope indicate that blue crabs orient significantly downslope in the range from 3 to 9° but not to as low as 1°. Field experiments under the condition of surge and slope in different directions seem to indicate an hierarchal response: wave surge being preferred to beach slope.

292. The Evolution of Male Parental Care in the Bony Fishes. LAWRENCE S. BLUMER, (Division of Biological Sciences, University of Michigan, Ann Arbor, Michigan).

The evolution of male parental care in the Osteichthyes is investigated by means of a literature review encompassing the 82 families in which parental care occurs. A precise definition of parental care is given and the conditions which determine whether parental care evolves in any organism are outlined. The prospects for further reproduction by the care-giving male and his probability of genetic relatedness to the offspring are examined in detail. The relationship between spawning sequence and the sex of the parental individual is considered with numerical data. A general hypothesis for the evolution of male parental care in the bony fishes is presented.

293. Mating System and Cost of Sex in a Simultaneously Hermaphroditic Seabass, *Hypoplectrus nigricans*. ERIC A. FISCHER (University of California, Berkeley).

Hypoplectrus nigricans (Serranidae, Pisces) is a simultaneous hermaphrodite with external fertilization and planktonic eggs. Spawning occurs only in pairs. Most fish spawn with only one partner/day; 3 is the maximum. There is no significant self-fertilization. During a spawn, one partner releases eggs and the other sperm. On average, individuals spawn 8-10 times/day, regardless of the number of partners. Members of a pair usually switch sex roles after each spawn. Courtship displays are associated with the female sex role. No displays are clearly associated with the male sex role. Individuals display alternately during pair formation and courtship. Most of the gonad consists of ovary; most physiological reproductive effort appears to be spent on egg production. Mating densities are not low, and sexual selection should lead to gonochorism in the absence of mechanisms which lower maximum reproductive success as a male. The mating system appears to do this by making mating success as a male contingent upon reproduction as a female. The adaptive value of such a system is that it reduces the 50% cost of sex: By investing most of its reproductive effort in egg production and trading egg for egg with its partners, a hamlet enjoys most of the fecundity advantage of a parthenogen without sacrificing sex. The hypothesis cannot account for the origin of simultaneous hermaphroditism--eggs cannot be traded with a gonochore. The hermaphroditism may have arisen under low density initially.

294. The Adenylate Energy Charge : Measurement of physiological stress in the estuarine molluscs *Pyrazus ebeninus*. ANGELA IVANOVICI (CSIRO Division of Fisheries & Oceanography, N.S.W., Australia)

The adenylate energy charge (AEC) was measured in the estuarine gastropod, *Pyrazus ebeninus*. In the laboratory, the AEC decreased significantly from 0.85 to 0.55 when salinity was reduced. A similar decrease was obtained when *Pyrazus* was exposed to a higher than normal temperature. *Pyrazus* was also placed in estuarine areas contaminated with hydrocarbons. The AEC was most reduced in animals that were exposed to the highest levels of hydrocarbons. Under both laboratory and field conditions, the AEC was significantly less than control values when environmental conditions appeared non-optimal. The response was consistent and generally occurred within 24 h. The variance in the estimates of AEC in both laboratory and field samples were low and allowed the use of small sample sizes (6 animals). These results suggest that the AEC can be used to measure the effects of stress or environmental change on organisms in stressed environments.

295. Flow Induced in the Mantle Cavity of a Keyhole Limpet (Gastropoda, Fissurellidae) by Environmental Currents. G. R. MURDOCK*(Duke University), S. VOGEL (Duke University).

Environmental water currents induce water flow through the mantle cavity of the keyhole limpet *Diodora aspera*. The flow induction is proportional to external current speed, even slight currents (5 cm sec^{-1}) giving three times the flow rate seen in animals pumping in still water. The orientation of the animal is important in determining the magnitude of the induced flow. The direct cost of normal pumping appears trivial, but augmented flow through the mantle cavity decreases the fraction of dissolved oxygen which the animal must extract from water passing the gills.

*Present Institution: Clemson University.

296. Long-Term Response of the Winter Flounder, *Pseudopleuronectes americanus*, to Sublethal Amounts of Cadmium. EDITH GOULD (National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Milford Laboratory, Milford, Ct. 06460).

Glycolytic, metal-linked, and metalloenzyme activities were measured variously in the heart, kidney-pronephros, liver, and gonad of winter flounder exposed for either 2 or 5 months to 10 ppb cadmium as chloride. Enzyme induction in heart and the kidney-pronephros tissue mass was observed at 2 months but not always at 5 months. Metalloenzyme induction occurred at 2 months in the male gonad but not in the female. No induction was observed in liver for either exposure period. In the kidney-pronephros, which is largely hematopoietic tissue, glucose-6-phosphate dehydrogenase had a lowered sensitivity to the positive modulation of magnesium, at both 2 and 5 months. This continuing impairment of catalytic efficiency suggests a cadmium-induced weakening of the metabolic flexibility necessary for adaptation to and survival under changing environmental conditions.

297. Respiration by Crabs in Air and Water. CLYDE F. HERREID II, (State University of New York at Buffalo), PATRICIA M. O'MAHONEY (University of Maine, Portland).

Oxygen consumption ($\dot{V}_{O_2}$), ventilation volume ($\dot{V}_G$), and oxygen extraction (E) were studied on three species of crabs from different habitats: *Callinectes sapidus*, an aquatic crab; *Cardisoma guanhumi*, an amphibious crab; *Gecarcinus lateralis*, a terrestrial crab. All species were tested in water and air. V_{O_2} in all species was highest in the normal environment: *Callinectes* has twice the $\dot{V}_{O_2}$ in water vs. air; *Cardisoma* showed a similar V_{O_2} in both media; *Gecarcinus* had a 6.5 times higher $\dot{V}_{O_2}$ in air compared to water. *Callinectes* and *Cardisoma* compensated for the low O_2 content of water (vs. air) with a three fold increase in V_G. *Gecarcinus* showed no difference in ventilation in the two media, along with a drastically reduced extraction (ml O_2/l). As a consequence this species can not survive more than a few hours of submergence before death.

298. Chemical Attractive Cues in Three Anabantoids. DAVID W. INGERSOLL and CHING-TSE LEE (Brooklyn College of the City University of New York).

An investigation was performed on three Anabantoid species - *B. splendens*, *C. lalia*, and *T. trichopterus* - to determine if an individual is attracted to a conspecific of opposite sex. A 20-gal. tank served as test apparatus with a pump siphoning water at one end of the tank and expelling water to the opposite side directly into a vertical intake tube. Each animal was given two 10-min. trials. The first test was with the animal's own water medium, whereas under the second test, the test water medium was either (a) previously inhabited by a conspecific of opposite sex, or (b) uninhabited fresh water. In addition, the physiological status of the females - whether as test animal or source of stimulus water - was either gravid or nongravid. Stimulus water was created by having an individual inhabit a tank containing one gal. of water over a 24-hr. period. The animal was then removed and its water siphoned, over a 10-min. period, into the pump's reserve tank. Stimulus water was then expelled into the vertical intake tube. Attraction to the test water medium was measured by the time spent distant and near the intake tube. Our findings indicated that the females of each species were attracted to conspecific males ($p < .01$). For female chemosignals, only the males of B. splendens were attracted to water previously occupied by a conspecific gravid female ($p < .01$).

299-306 ZOOLOGY (PHYSIOLOGICAL) WED., 15 FEB., 9 A.M./ SA COUNCIL

299. Beta-Adrenergic Desensitization of Myogenic Cells by Isoproterenol.

M.SCHONBERG,R.C.BENN and M.APFELBAUM (Dept. of Neurology and the H.H.Merritt Clinical Research Ctr.for Muscular Dystrophy and Related Diseases,Coll.of Physicians and Surgeons,Columbia University,New York).

The rat myogenic cell line,L_8,acquires beta-adrenergic receptors prior to the start of fusion and thereafter.This process can be completely blocked by 0.1 mM isoproterenol when added to the cells no later than about 30 hrs prior to the start of fusion.This drug at 0.1 μM inhibits fusion by 50%.The inhibition of fusion is reversible and stereospecific and is not dependent on cell density.It is coupled with reversible inhibition of catecholamine-sensitive adenylate cyclase,cyclic AMP accumulation and"specific"(^{125}I)IHYP-binding.

These cells may serve as a model to study the relation of beta-adrenergic desensitization to differentiation.

300. Increased Activity in the Second Generation of Rats Fed a Mixture of Food Additives

OLUKEMI O. OLUBAJO (Howard Univ.) and LUCILE F. ADAMSON (Howard Univ.)

To explore the possibility that increased activity may be induced by mixed food additives, male rats were given, as their sole source of fluid, tap water or a ½-strength mixture of 9 flavors of an unsweetened soft-drink mix. Major ingredients of the mixture were citric acid and monocalcium phosphate (totaling 88.9% of the dry weight) and smaller amounts of other ingredients including sugar (2.9% dry weight) and various artificial flavors (2.4% dry weight) and colors (0.7% dry weight).

Fluid intakes and voluntary running activity of two generations were measured from weaning to age 4 months.

The amount of drink mix consumed was equivalent, on a body-weight basis, to approximately 1.5 L/day of soft drink by a 30-kg child. There were no consistent differences in the amounts of fluid consumed by the various groups.

The second generation of rats drinking the additive mixture, borne and suckled by dams who also had received the mixture from one week before mating until the pups were weaned, exhibited significantly higher running activity during the 6-16 week age span than did control pups. Control and additive-fed groups of the first generation, whose dams had not received the mixture, had shown no such differences. The ingredient(s) responsible for the effect has not yet been identified.

301. Urea Catabolism Affected by Fasting and Drug Treatment in C. lateralis.

J. M. STEFFEN & M. L. RIEDESEL (Dept. of Biology, Univ. of New Mexico, Albuquerque, N.M. 87131).

The hibernator must tolerate buildup of metabolic end products which may arise during bouts of hibernation. Furthermore, during periodic arousals, the hibernator may not excrete before reentry into hibernation. Experiments were conducted to identify the extent to which ground squirrels may catabolize urea during periods of fasting. Squirrels were injected (i.p.) with 0.3g urea/100g body weight containing 10 μCi ^{14}C-urea. Following the injection, the animals were placed in a metabolic chamber with an air flow of 150-250 ml/min. Respiratory CO_2 was collected in ethanolamine traps for 24 hr. Urine was collected for 48 hr from the time of injection. Control animals had food and water ad. lib. whereas experimental animals were fasted 3-4 days and no water 1 day prior to the urea injection. The urine of control animals contained 4 to 5 times the radioactivity of animals fasted 3-4 days (average weight loss, 19%). At the same time, the fed squirrels produced only 40-45% as much $^{14}CO_2$ as the fasted animals. This leads to the hypothesis that fasted ground squirrels possess an increased ability to catabolize urea. Fasted squirrels treated with sodium sulfamethazine (American Cyanamid, 0.02% in drinking water) or tetracyline (American Cyanamid, 5g/500ml, 5ml by stomach intubation) had decreases in $^{14}CO_2$ collected of approximately 25% and 50% respectively. These findings emphasize the importance of microbial flora in the intestinal tract of the animal.

302. Ventilation and Oxygen Extraction during flight in the Bat Pteropus gouldii.

STEVEN P. THOMAS (Duquesne University Pittsburgh, Pa. 15219).*

Ventilatory frequencies (f, breaths min^{-1}) and inspired tidal volumes (V_T, cm^3 STPD) were measured from the bat P. gouldii (body mass = 0.870 kg) during steady windtunnel flight at various combinations of air speed (S, $m\ s^{-1}$) and flight angle (θ) by a flow probe which operated on the hot-wire anemometer principle, and which was attached to a latex mask worn by the bat. At each θ studied, f varied in an inverse manner with S. During level flight ($\theta = 0^\circ$) f ranged from 192.1 @ 8.0 $m\ s^{-1}$ to 178.8 @ 9.9 $m\ s^{-1}$. At a given S, f tended to decrease as the flight angle became progressively more downhill (i.e., θ more negative). V_T increased with increasing S at each θ. For level flight, V_T varied from 36.6 @ 8.0 $m\ s^{-1}$ to 41.0 @ 9.9 $m\ s^{-1}$. For a given S, V_T decreased from its level flight value by about 11% (for $\theta = -2^\circ$) or 31% (for $\theta = -4^\circ$). These data together with flight $\dot{V}_{O_2}$ data previously reported for this particular bat were used to calculate oxygen extraction (E) values $[E = \dot{V}_{O_2}/(\dot{V}_I \cdot F_{I_{O_2}})]$ where E is the fraction of the inspired oxygen removed by the respiratory system. During level flight, E ranged in value between 0.09 and 0.10 for P. gouldii: values which are substantially less than those reported for birds flying at comparable temperatures and flight conditions.

*This research was supported by N.I.H. Postdoc. Res. Fellowship #1-F02-AM52033-01, and was performed at Duke University, Dept. of Zoology.

303. Enzymatic Studies of the Metabolic Adaptation in Response to Protein-Calorie Malnutrition.

S. HUJJATULLAH and M. Ataur RAHMAN. (Department of Biochemistry, Jinnah Postgraduate Medical Center, Karachi-35, Pakistan)

To assess the lipogenic and gluconeogenic capacities of liver in Protein-Calorie Malnutrition (PCM), the enzyme activities were determined. White albino rats were subjected to PCM by feeding low proteins diets beginning from gestational, suckling or weaning stage. They were sacrificed on 21st, 42nd or 63rd day of life. Blood lactate, pyruvate and plasma α-amino nitrogen were found to be elevated but plasma glucose and serum total iron binding capacity were decreased in rats fed low protein diets. The livers from the protein depleted rats were low in protein but were profusely fatty. The activities of liver glucose-6-phosphatase, fructose-1, 6-diphosphatase, PEP-carboxykinase and α-phosphorylase per g wet weight decreased following chronic deprivation of dietary proteins but the effective level (units/100 g wet weight) and the specific activity (units/mg liver protein) of these enzymes were well maintained, excepting one representing *in utero* protein deficiency. ATP-citrate lyase, α-glycerophosphate dehydrogenase were severely depressed in PCM. It seems that PCM suppresses the lipogenic processes more than gluconeogenic capacity of the liver. The most critical period as regards the effect of PCM on the liver enzyme activity and the metabolic homeostatic control, is the gestational life.

304. Serum Compositional Changes in Chicks Caused by Supplementary NaF in Diet. M. H. YU (Western Washington University), M. P. STOEHR (Western Washington University).

Chicks raised on a diet supplemented with 150 ppm of fluoride (as NaF) were analyzed for their serum albumin, glucose, and cholesterol contents, and the alkaline phosphatase activity. The results were compared with those of samples from control chicks fed basal diet only. At the end of five weeks after treatment was started, serums from the fluoride-treated chicks showed marked increases in the concentrations of albumin, glucose, and cholesterol, as well as in the alkaline phosphatase activity (48, 21, 27 and 72% respectively). At the end of eight weeks, however, these increases either disappeared or greatly diminished. These results suggest that fluoride caused a disturbance in the metabolism of those components and the enzyme activity in the young chicks, and that as the chicks grew older they might have become more resistant to fluoride or they might have developed alternative metabolic pathways.

305. Liver Lesions of Pigs Fed Dietary Oils. AMREEK SINGH SHIGETO YAMASHIRO and S. J. SLINGER (Departments of Biomedical Sciences and of Nutrition, University of Guelph, Guelph, Ontario, Canada).

There is a deficiency of knowledge about the effects of feeding certain dietary oils on liver in pigs. Hence a study with the following protocol was designed: pigs that served as controls were fed a ration containing corn-soybean meal; experimental diets contained 10% of rapeseed oil (erucic acid ca. 39%) or soybean oil or Herring fish oil. The livers of three animals, from each treatment, were studied with the light-and electron-microscope after 10 weeks of experimental feeding. Histologically, livers of rapeseed oil-fed pigs showed centrilobular necrosis, and lipid accumulations were observed in the sinusoidal lining cells. Two animals on soybean oil diet had fatty livers. Minute necrotic foci were present in the liver lobules of two fish oil-fed pigs. Ultrastructurally, hepatocytes from the group fed the rapeseed oil exhibited a hypertrophy of smooth endoplasmic reticulum. This lesion was random in cellular distribution and was mild to severe. The hepatic cells of the soybean oil-fed pigs contained numerous lipid droplets. An increase of smooth reticulum with or without an accumulation of lipid was seen in liver parenchymal cells of animals on the fish oil diet. The lesions, although distinctive, are not unique to the treatments.

(Supported by NRC Canada and OMAF).

306. Regulation of Fatty acid synthesis in rat liver by the Thyrotropin hormones. DIPAK K. DAS(Long Island Jewish - Hillside Medical Center) and MANIK GANGULY (New York University Medical Center).

The thyroid stimulating hormone (TSH) and thyroid releasing factor (TRF) have been found to stimulate hepatic Acetyl CoA Carboxylase (ACC) and Fatty acid Synthetase (FAS) levels of diabetic rats. Subcutaneous administration of TSH (100 munits per 100 gm. body wt.) or TRF (100 μgm per 100 gm.body wt.) can increase ACC or FAS levels of diabetic animals to about 12 times and 8 times respectively in 24 hrs. and can be able to maintain these levels upto a period of 72 hours. After 72 hours,however,these levels drop gradually. Moreover,TSH exerts its stimulating effects on ACC and FAS levels of diabetic animals in two separate steps. After 4 hours of TSH administration to diabetic rats,ACC and FAS levels begin to rise slowly upto a period of 12 hours, after which both ACC and FAS levels rise at faster rate. ACC and FAS induction cannot be inhibited by Cycloheximide or Actinomycin D during first 12 hours of TSH administration. The second half of the increase in ACC and FAS levels (i.e., after 12 hours of TSH administration) can be significantly inhibited by Actinomycin D or Cycloheximide. These observations clearly implecate that TSH plays a significant role in the short term as well as in the long term control of the synthesis of hepatic ACC and FAS. (Supported in part by a grant from New York University Medical Center).

307-314 Zoology (Neural & Visual) — Wed., 15 Feb., 3 p.m./ SA Council

307. Temporal Properties of Rod and Cone Input to Turtle Ganglion Cells. C.A. DVORAK, J.E. FULBROOK and A.M. GRANDA (University of Delaware).

Post-stimulus time histograms (PSTHs) of single-unit recordings from turtle optic nerve reveal fundamental response kinetics of various ganglion cell types. By observing ON, ON-OFF, OFF and sustained responses to monochromatic stimuli under dark- and light-adapted conditions, rod and cone input can be distinguished - as well as inputs from different cone types. Specifically, PSTHs for 640 nm light indicate shorter response latencies and times-to-peak than PSTHs of responses to 520 nm or 450 nm light. Cone inputs are readily distinguished from rod inputs, as the latter show up in PSTHs as discharges with very long latencies. In ganglion cells with strong cone inputs light adaptation produces a synchronized spike train that is not seen in dark adaptation. There are also spatial aspects concerning different receptor inputs to ganglion cells: rod-mediated surrounds of receptive fields produce long-latency OFF responses. All these results provide evidence for wavelength discrimination on the basis of the time course of the neural response.

308. Drosophila Ocelli. HU, K.G., REICHERT, H.,* STARK, W. S., (Johns Hopkins University, Baltimore, M.D., *Universität Freiburg, Federal Republic of Germany).

Drosophila have 3 simple eyes, ocelli, in addition to 2 compound eyes. We determined ocellar function using the electroretinogram (ERG) and vision mutants.

The light-elicited ERG waveform was a negative wave repolarizing to half V-max in about 2 s during the stimulus. At light-off the ERG had a positive overshoot that returned to half-baseline in 4 s.

The ocellar ERG had similar intensity-response function slopes and waveforms across wavelengths from 350 to 545 nm. The ocellar spectral sensitivity had UV (370 nm) and blue (445 nm) peaks. Chromatic adaptation did not selectively reduce the 370 vs. 445 nm peak sensitivity. These findings offer no support for more than one ocellar receptor type.

We compared ERG responsivity of normal and mutant *Drosphila* lacking compound eye and/or ocellar screening pigments, lacking one or more compound eye receptor types, or having abnormal receptor potentials in the eye. Differences in the ocellar response would suggest that the mutant gene had pleiotropic effects, or that abnormal compound eye function eliminated some recordable interaction with ocelli.

Our results suggest that the absense of screening pigments or compound eye receptor types has no effect on the ocellar ERG. However, 2 mutants with abnormal compound eye receptor potentials had similar ocellar abnormalities.

309. Effect of Neurotransmitters on the Cyclic Nucleotide Phosphodiesterase (PDE) in the Central Nervous System of Manduca sexta. DUNCAN P. TAYLOR*, DENISE E. ROBERTS, and CHRISTINA M. MARRA (Department of Biochemistry & Biophysics, Oregon State University, Corvallis, OR 97331). *Present address: Biochemistry Section, Adult Psychiatry Branch, NIMH, Bethesda, MD 20014.

The putative neurotransmitters serotonin, acetylcholine, aspartic and glutamic acids, glycine and γ-aminobutyric acid, as well as the PDE inhibitor theophylline (THEO), elevate levels of cyclic nucleotides accumulated in intact pooled nerve cords and in neuronal-enriched fractions from the tobacco hornworm (J. Insect Physiol. 22, 1303). Using homogenates of nerve cords from fifth larval instar "wanderers" we have extended our previous PDE studies (BBA 377, 364). Using THEO as a model compound we have found that cyclic AMP-PDE inhibition begins at 40μM and inhibits 50% of activity at 1.3mM THEO in the presence of 50μM substrate. At 20mM THEO we observe over 90% inhibition. A number of neurotransmitters had no effect on PDE activity. The effect of 250μM dopamine (DA), which was strongly inhibitory, could be abolished by the addition of 20μM phenylthiourea (PTU). We conclude that DA is acting as a protein cross-linking agent after quinone formation by a hemolymph-borne phenol oxidase. Serotonin also inhibits the PDE in the presence or absence of PTU, and in a purified soluble form (105,000xg, 60 min) of the enzyme which is free of 5'-nucleotidase activity. (Supported in part by NIH grant NS-09161-20 to R.W. Newburgh.)

310. Studies on an Anophthalmic Strain of Mice: VI. Lens and Cup Interaction. HERMAN B. CHASE (Brown University), NEIL GONSALVES (Rhode Island College), CAROL HORCH (Brown University).

In the embryology of the eye region in the anophthalmic strain of mice (ZRDCT/Ch) development proceeds normally until day 10 (26 somites). At this time a lens is induced but it is smaller in size and may be improperly centered in the optic cup. Where the lens is centered in relation to the optic cup determines whether microphthalmia or anophthalmia will occur. Also, we observed that optic cup formation is different in normal control strains.

311. The effects of amphetamine on motor activity of mice with pigmented and nonpigmented eyes at two different ages. HARVEY MONDER, ZITA WENZEL, PETER J. DONOVICK, RICHARD G. BURRIGHT (State University of New York at Binghamton).

A heterogenous strain of mice derived at SUNY-Binghamton from the intermating of 8 pure-bred strains of mice was used in this study. This intermating produces mice with pigmented and nonpigmented eyes. Male mice at either 60 - 90 days of age or 200 days of age were used. Gross motor activity was measured by use of Stoelting activity monitors for a 30 minute period. Measures were taken under dim light (10 min.), stroboscopic light (10 min.), then dim light again (10 min.). Each animal was injected, i.p., with d-amphetamine sulfate 2 mg per kg. or saline 30 minutes before testing. In the younger animals, amphetamine produced an increase in activity for the pigmented and a decrease in activity for the nonpigmented animals. At 200 days of age, the drug resulted in a decrease in activity for the drugged animals regardless of eye color. The strobe had little effect on the activity of the animals at either age, but in the younger animals the pigmented drugged animals showed a small initial increase in activity and the nonpigmented animals showed a small initial decrease in activity upon onset of the strobe.

312. The Effects of Hippocampal Lesions on Gluconeogenesis in the Rat. CYRILLA H. WIDEMAN (John Carroll University), HELEN M. MURPHY (John Carroll University), adn THOMAS S. BROWN (DePaul University).

It has previously been demonstrated that rats with hippocampal lesions gain weight at a slower rate than control animals. At autopsy animals with hippocampal lesions typically show much less adipose tissue than control animals. One physiological process which may contribute to the observed phenomenon is gluconeogenesis. In gluconeogenesis there is an increase in plasma urea which results from the degradation of proteins (amino acids). Two experiments were conducted using the BUN Test to assess the circulating levels of urea in the plasma. In the first experiment plasma urea levels were measured at a point 1 hr. into the light phase of the light-dark cycle. Animals with hippocampal lesions had a plasma urea concentration that was significantly higher than the control groups. In the second experiment plasma urea levels were measured at 3 hr. intervals during the 24 hr. light-dark cycle. All three groups showed a diurnal variation with major and minor peaks and major and minor troughs. The pattern of variation was similar in the two control groups. The amount of plasma urea nitrogen for animals with hippocampal lesions was significantly higher than control animals at both peak periods. In addition the major peak was shifted 3 hrs. in the hippocampectomized group. The observed changes may be explained in terms of hormonal influences upon gluconeogenesis and concomitantly fat metabolism.

313. Effects of Superior Colliculus Lesions on Visual and Acoustic Obstacle Avoidance in Bats. J. CHASE (Columbia University), L. RUBIN (University of Colorado), and G. BALL (Rockefeller University).

The ability of adult bats, P. hastatus, to avoid obstacles visually (deaf) and acoustically (blind) was tested with reversible sensory impairment procedures. The SC was then lesioned and the animals re-tested 5 days later. The results are: (1) the ability to avoid obstacles visually deteriorated following SC lesions. (2) Acoustic obstacle avoidance was unimpaired. (3) The degree of visual impairment correlated with lesion size. (4) There is a suggestion that acoustic obstacle avoidance is actually enhanced by SC lesions. We conclude that in the bat, P. hastatus, at least, the SC functions primarily to guide visual localization tasks and not as a bimodal integration center per se.

314. Microwave Effects on the Nervous System and Behavior

ALLAN H. FREY (Randomline, Inc., Huntingdon Valley, PA)

During the past three years, there have been numerous reports in the public media about the biological effects of so-called low intensity microwaves and power line exposure. Unfortunately, these reports are not in the same context as the rapidly increasing body of data that exists in this area. "Low intensity" effects have been observed in controlled laboratory experiments, particularly nervous system and behavioral experiments. Conclusions about hazards for humans, however, are not so easy to draw.

In this presentation, experiments carried out in this laboratory showing an effect of low intensity microwaves on the blood brain barrier, aggressive behavior, and avoidance behavior will be described and related to other such work.

In the brain barrier experiment, fluorescein was used as a tracer. It was found that exposure to low intensity microwaves resulted in the appearance of fluorescence in the diencephalon and metencephalon. In pairs of male rats exposed to the energy during tail pinch induced fighting, it was found that microwaves had a "calming" effect. In shuttle box avoidance, it was found that animals tended to avoid exposure to low intensity microwaves.

315. The Rat as a Model of Physical Dependence upon Ethanol. EDW. MAJCHROWICZ (Lab. Biopsychosocial Res., NIAAA, ADAMHA.

A model of addiction is essential for studies of neurobiological correlates of acute and chronic effects of ethanol (Eth). Physical dependence upon Eth was induced in rats by intragastric administration of 20% Eth at 9.9 ± 2.4 g/kg in 4 to 6 fractional doses daily for 4 days. Administration of the last dose marked the initiation of the ethanol withdrawal period, during which 2 phases were distinguished: 1. The prodromal detoxication phase was characterized by a spectrum of signs and responses (S & R) of intoxication of diminishing severity: death, coma, loss of righting reflex, ataxia 1, 2, and 3, sedation, and neutrality. 2. As the BEC approached 150 mg/dl the onset of the ethanol dependence phase was manifested by the emergence of a spectrum of ethanol withdrawal S & R of progressive severity: hyperexcitability, tremors, stereotypy, akinesia, rigidity of tail and body, chattering teeth, wet shakes, and spontaneous convulsions. The physical dependence upon Eth in rats is in several respects similar to convulsive and tremulous components of Eth withdrawal syndrome in man. These include a short induction period, the total amount and the temporal distribution of Eth doses, the rectilinear clearance of blood Eth during the prodromal detoxication phase, the onset and the time course of withdrawal S & R, and the reversal in the CNS function from the extremes of depression to the extremes of hyperexcitability.

A motion picture will demonstrate typical signs and responses of the ethanol withdrawal syndrome in rats.

316. Perinatal Methadone Exposure and Body and Organ Development in Rat. PATRICIA J. MCLAUGHLIN (The M.S. Hershey Medical Center), IAN S. ZAGON (The M.S. Hershey Medical Center), WILLIAM J. WHITE (The M.S. Hershey Medical Center).*

The effects of maternal methadone (5 mg/kg methadone-HCl) administration on gross body measurements, absolute organ weights (AOW), and tissue water content (TWC) were studied in 21-day old Sprague-Dawley rats treated during gestation and/or lactation. Weaned offspring perinatally exposed to methadone had significantly lower body weights, crown to rump lengths, tail lengths, and head diameters. In comparison to age-control values, AOW of the adrenals, brain, heart, kidneys, liver, lungs, m. triceps surae, and testes were reduced in all rats treated during gestation and/or lactation, while the spleen, ovaries, and thymus were lighter in weight in some groups of methadone-treated animals. Organ to body weight ratios revealed fewer significant differences than recorded for AOW, with rats in the gestation group exhibiting the greatest number of reductions. TWC, calculated as the difference in wet and dry organ weights, was significantly different from control values for the kidneys, liver, and muscle of all drug-exposed rats; other organs were markedly affected by at least one schedule of methadone administration. These results indicate that perinatal methadone exposure has detrimental effects on preweaning body and organ development and may be of long-term consequence to the animal.

*Supported in part by NIDA Grant DA-01618-01.

317. The Influence of Perinatal Methadone Exposure on Body and Skeletal Development in the Rat. WILLIAM J. WHITE (The M. S. Hershey Medical Center), IAN S. ZAGON (The M.S. Hershey Medical Center),*PATRICIA J. MCLAUGHLIN (The M. S. Hershey Medical Center).

The effects of methadone (5 mg/kg methadone-HCl), maternally administered during gestation and/or lactation, on gross body and skeletal measurements were studied in 21-day old rat offspring. In comparison to control animals of the same age, methadone-exposed pups had significantly lower body weights, crown to rump lengths, tail lengths, and head diameters. The lengths and cross-sectional diameters of bones from both the upper and lower extremities were significantly reduced in all drug-treated rats. There were no differences in gross body or skeletal measurements between males and females. No significant differences in bone dimensions were recorded between drug-treated pups, indicating that regardless of the time and duration of methadone exposure, bone development appeared to be affected in a similar manner. These findings suggest that perinatal methadone exposure alters body and skeletal growth and may be of long-term importance to the physical development of the animal.

*Supported in part by NIDA Grant DA-01618-01.

318. Paradoxical Response to Amphetamine in a Hyperkinetic Adult. JOSEPH DEVEAUGH-GEISS, M.D. (Syracuse Veterans Administration Hospital and Department of Psychiatry, SUNY Upstate Medical Center, Syracuse, New York 13210) and ANTHONY JOSEPH, M.D. (Department of Psychiatry, SUNY Upstate Medical Center).

The syndrome of the hyperkinetic child and the paradoxical response to stimulant drugs may persist into adulthood. Although contemporary theory suggests that this response to drug treatment is the result of stimulation in an understimulated nervous system, evidence supports the hypothesis that some individuals respond to stimulant drugs in a truly pharmacologically paradoxical fashion. We have systematically studied one adult with the hyperkinetic syndrome who responds to dextroamphetamine with reduction in anxiety and motor activity, marked depression with suicidal ideation, extreme drowsiness with the induction of deep sleep, reversal of photic driving on electroencephalogram, and pupillary constriction. The study was conducted in double-blind fashion with placebo control. Responses were measured by self-rating scales, behavioral rating scale, electroencephalogram, and photographic measurement of pupillary size.

319. Opiate Antagonist Counteracts Reproductive Inhibition by ACTH. NORIE YASUKAWA, HARVEY MONDER, SANDRA D. MICHAEL, JOHN J. CHRISTIAN (State University of New York at Binghamton).

Opiates and ACTH block reproductive function in female mice. Opiate antagonists inhibit the actions of opiates by competitively binding at receptor sites. We explored the possibility that ACTH blocks reproduction by binding at opiate receptor sites. Female *Mus* were injected daily with 4 I.U. of porcine ACTH (71 I.U./mg) from day 21 to day 60 (day of birth=0). A similar group of control mice were injected with saline. The opiate antagonist, Naloxone was administered in subcutaneous, silastic implants to 1/2 of each group on day 40, after all control animals showed vaginal opening. The Naloxone release rate averaged 40 μg/day. All animals were sacrificed on day 60. Reproductive function was assessed by daily vaginal smears, organ weights, histology and RIA measurements of LH plasma levels. The results showed that ACTH-Naloxone, Saline-Naloxone and Saline-Saline groups were significantly different from the ACTH-Saline group for the parameters studied. Reproductive inhibition appears to be unblocked in the ACTH-Naloxone group and suggests that ACTH may inhibit reproductive inhibition by binding at the opiate receptor sites.

320. Fetal Exposure to Addictive Drugs and Neonatal Sleep. DAVID F. DINGES* and MIRYAM M. DAVIS (Children's Hospital National Medical Center and The George Washington University Medical Center).

Disturbed sleep has been observed as one of the behavioral symptoms exhibited by human newborns chronically exposed *in utero* to addictive drugs. During a midday interfeed sleep of infants 1-5 days old, electrophysiological and behavioral parameters were recorded from 30 babies of opiate-dependent methadone-treated mothers with and without associated illicit drug use, and 30 demographically matched control neonates. Groups did not differ in total time asleep or mean age. Active-REM (AS), Quiet (QS), and Indeterminate (IS) sleep states were scored blind using standard criteria. Drug exposed newborns averaged less QS ($p< .001$), and reciprocally more IS ($p< .01$) and AS ($p< .05$) than controls. Infants of drug dependent mothers were categorized by maternal drug history into Low, Moderate, and High drug exposure groups. Mean QS decreased while mean IS increased from Low to High groups (Interaction $F=7.1, p< .01$). These results suggest that disturbances of neonatal sleep (midday "nap") are a sensitive physiological index of maternal drug use. Further work is needed to determine the duration of these sleep changes, and the nature of the effects they reflect on the developing nervous system.

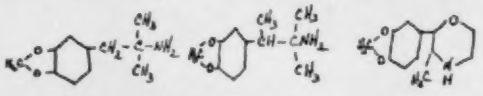
*Current Affiliation: The Institute of Pennsylvania Hospital and University of Pennsylvania

321. Naloxone Blockade of Apomorphine Induced Stereotyped Behavior; Role of Endogenous Opiates. D.I. MARGOLIN (Rush University), B.H. MOON (Rush University).

Morphine can block the stereotyped behavior (S.B.) induced by dopaminergic agonists such as amphetamine or apomorphine. This S.B. is thought to be a reflection of supranormal activity of dopamine (da) receptors in the corpus striatum. The purpose of this study was to determine the interaction of endogenous opiates with brain da by observing the effect of naloxone on apomorphine induced S.B. Group A and group B each consisted of 12 250-350 gm white male guinea pigs. Gr. A animals received 0.1, 0.15, 0.2, 0.25 mg/kg of apomorphine with 1-2 days between doses. Gr. B animals received an equal dose of apomorphine in addition to 0.4 mg/kg of naloxone. All drugs were given by subcutaneous injection. Immediately following the injection the animals were rated on a stereotype scale of 0-4 for a period of one hour. Gr. A animals showed a significantly greater degree of S.B. for each dose of apomorphine than did gr. B animals. This experiment demonstrates the ability of naloxone to block S.B. induced by the direct da agonist apomorphine. Endogenous opiates may therefore exert a tonic dopaminergic effect on the corpus striatum.

322. Influence of the Methylenedioxy Moiety On the Anorexigenic Response of CNS Stimulants. W. Leonard Pickard (California State University, San Jose)

Introduction of the methylenedioxy group into the ring structure of several sympathomimetic compounds yielded structures with properties potentially applicable to hypertensive and psychiatric disorders. Among the novel configuations synthesized (all as their racemic modifications) are:



Unusual subjective manifestations and alteration in dosages and LD_{50} are discussed with regard to the above analogs.

323. Teratogenic Effects of Altered Tryptophan Levels During Embryological Development of the Chicken C. J. Sherry, R. E. Herron (Texas A & M University)

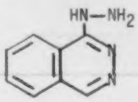
Fertile White Leghorn chicken eggs were obtained from the Kazmeier Hatchery (Bryan, TX) and incubated under standard conditions for 96 hours and then injected, via the air sac, with 0.1 ml of sterile distilled water (60 eggs), or 1.0 mg (30 eggs) or 5.0 mg (30 eggs) of L tryptophan dissolved in the same volume of sterile distilled water. The eggs were then incubated to hatching and all chicks, both those that hatched and those that died during incubation were subjected to a standard autopsy procedure. By observation of the intact embryo, it was noted that a major anomaly occurred in each experimental group and none in the control group. At the 5.0 mg dose, the chick died at stage 34 (Hamburger and Hamilton, J. Morphol. 1951, 88, 49). This chick showed agenesis of the fibula, tibiotarsus, tarsometatarsus, and the phalanges of one limb and failure of the abdominal wall to close. At the 1.0 mg dose, the chick died at stage 40. This chick showed agenesis of the premaxillary, maxillary, nasal, and mesethmoid bone. These bones are also either absent or greatly reduced in size: palatine, prefrontal, jugal, exoccipital, supraoccipital, basioccipital. Both of these chicks will be subjected to further analysis, but we believe that the second chick may represent a new anomaly.

324. Neuropharmacological Properties and Mutagenic Activity of Three Extracts of *Dimorphandra mollis* Benth. Naismith, Robert W., Patricia A. Hoffman*, James A. Weiss, Susan M. Daniels*, and Richard J. Matthews* (Pennsylvania State University and Pharmakon Laboratories*)

Dimorphandra mollis Benth, a plant from the Caesalpiniaceae family which is very common in Brazil has been reported to be toxic to cattle, with the capacity to provoke abortions. Furthermore, it has been implicated to have a blocking effect on one and perhaps two forms of experimental mouse cancer. Both an aqueous and an alcohol extract have been reported to have effects against smooth muscle activity. Because of its reported pharmacological activity, reported anti-cancer effect, its toxicity to animals as well as similar reports of other naturally occurring mutagens, we decided to investigate its neuropharmacological and mutagenic activity. In a neuropharmacological profile, both the crude and refined methanol extracts showed neurological and toxic effects at the 300 mg/kg level when injected i.p. At lower levels there were few, if any, effects. A 300 mg/kg dose given p.o. showed little abnormal effects. An ethyl acetate extract at 300 mg/kg (i.p.) produced some depression and decreased activity. When these extracts were analyzed in the plate incorporation assay Ames test at 7 dose levels no mutagenic activity was observed using five tester strains of *Salmonella typhimurium*, TA1535, TA1537, TA1538, TA98, and TA100 with and without metabolic activation.

325. Synthesis and Antihypertensive Evaluation of Hydrazine-Containing Heterocycles. S. ELROD, S. KASINA and J. NEMATOLLAHI (College of Pharmacy, University of Texas at Austin, Austin, Texas 78712).

A series of hydrazine-containing compounds (exemplified in the scheme below) related to hydralazine has been synthesized and tested for antihypertensive activity. Four representative compounds were selected. Each was tested by injection into the jugular vein while the carotid artery was canulated for monitoring the blood pressure simultaneously with the EKG and respiration. The dihydrazine derivative (2) was the most active of the series. It decreased blood pressure to a greater degree than hydralazine, used as a control. Additionally, 2 did not show tachycardia, an undesirable side effect of hydralazine.



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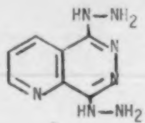

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326. Diphenylhydantoin Administration and Residual Alveolar Ridge Resorption. HUGH F. MACKAY (University of Toronto), JUDITH C. SHYKOFF (University of Toronto), GEORGE SANDOR (University of Toronto).

After teeth are lost, the alveolar bony ridge that supported them reduces in size. Sodium Diphenylhydantoin (DPH), used in the management of chronic grand mal and psychomotor epileptic seizures, has been found to enhance bone healing and to produce gingival hyperplasia. It was felt that this drug might also help to maintain alveolar bone after tooth loss. Dental radiographs of twenty-two epileptic patients who had been receiving long term DPH therapy were assessed and the amount of mandibular alveolar ridge reduction was evaluated for each. Thirty-four control patients of comparable ages, receiving no medication nor suffering from any metabolic condition known to affect bone, were similarly assessed. The DPH group showed significantly less reduction of the residual alveolar ridge ($p < 0.01$) than did the control group.

327. International Health Technology Exchange - A Multi-Directional and Multi-Disciplinary Road. J. S. PRINCE (USAID Ret.), DENNIS G. CARLSON (Johns Hopkins University).

The paper starts by tracing the historical background of health technology exchange and its significance to improvement of health and well-being world-wide. A case is then made for present and future use of innovative approaches to improving the health components of development, building on already established concepts. Emphasis is placed on the principle of adaptation to peculiar health, socio-cultural, human and economic requirements of target groups rather than outright adoption of any one approach. The point is made that transfer of certain types of health technology between developing nations and from developing nations to the more industrialized ones has been and continues of major importance to both. Emphasis is placed on need to consider such concepts as-: 1) Well-rounded health human resource development; 2) Design and implementation of training programs based on prevalence studies/information concerning major health problems, and related task analysis; 3) Importance of attention to development and application of management and planning skills at all levels including those skills related to knowledge of the community and its socio-cultural and economic organization; 4) emphasis on the interdisciplinary approach to training and health service components of applied health technology and 5) appropriate methods for evaluating health program effect. Examples are given which show how these concepts have been applied in certain instances and why they are important.

328. Psychiatry and Psychotherapy: Is a Divorce Imminent? CLAUDE T. H. FRIEDMANN, M.D. (University of California at Los Angeles - Harbor General Hospital Campus)

Despite the long tradition of psychiatrists practicing psychotherapy, many psychiatric and medical leaders are predicting and urging a re-orientation of psychiatry towards the medical model. They would leave psychotherapy to psychologists, social workers, and the like. Many social, governmental, and institutional factors favor such a change. The author points out that the marriage of psychiatry and psychotherapy has always been an uneasy one, and that the push for divorce may be irresistable. The author cautions, however, that such a divorce could be detrimental to medicine, by substituting, in the name of "science," a dehumanized, technological psychiatry for the current "moral" treatment. Several examples of the value of psychotherapeutic techniques to the practice of medical psychiatry are cited. Writings are noted which support a broader approach to psychiatry, combining biological, neuromedical, socioenvironmental, and psychodynamic input. The author concludes that divorce, though imminent, should be resisted.

329. **Interactive Computer Tests as a Psychiatric Audit ALICK ELITHORN, ALEX TELFORD (Institute of Neurology & The Royal Free Hospital, London).**

Psychiatrists are criticised for prescribing a range of intrusive physical treatments without evaluating the balance of beneficial and harmful effects in individual cases. Standard psychological tests are in general unsuitable for the repeated reassessment of intellectual, perceptual and motor skills which is needed if such treatments are to be adequately monitored. Amongst the applications of computer techniques to medicine the development of interactive psychological tests has figured hardly at all. Interactive computer control greatly enhances the power of psychological tests by providing an accurate control of stimulus duration and a more detailed analysis of the subjects performance. Computer presentation also allows the interactive application of process control, computer item generation and randomised stratified item selection which make possible the use of criterion referenced tests suitable for repeat testing. The application of a number of such interactive tests (a digit span test of memory, a coding test, the Perceptual Maze Test, motor tapping and R.T. tests) to the daily assessment of patients treated with E.S.T. and psychotropic drugs is described. The findings show that interactive testing is capable of providing a behavioural analysis which provides a cost effective method for monitoring a wide range of psychiatric treatments.

330. Ocular Mechanisms through which Sociological, Psychological, and Environmental Conditions can Cause Myopia: Conflicts among Functions of Contractions of the Orbicularis Oculi and Other Facial Muscles. RICHARD MCCLINTOCK (University of California, San Diego).

Functions of the orbicularis oculi and other facial muscles that surround the anterior of the eyes include protection of visual acuity during emotions that increase the force of blood to the eyes, nonverbal communication (facial expressions), and other functions that can conflict. During various conditions in which sociological, psychological, and environmental functions conflict with ocular functions, visual acuity decreases. Most of the decrease is temporary, but some of it is lasting and cumulates through repeated occurrences of the conditions, causing myopia. This can explain many previously unexplained complex relationships between myopia and sociological, psychological, and environmental variables, e.g., close work. In terms of physiological theory, increased pressure inside the orbits, without contractions of the orbiculars pressing on the anterior surfaces of eyes, causes eyes to bulge anteriorly. After the increased internal pressure terminates, the largely resilient eyes return to almost their previous shapes, but a slight stretching of the tissues makes the eyes slightly longer than before, which cumulates and causes myopia. (In another paper I report on hyperopia and astigmatism, and on orbicular contractions that are retroactively compensatory.)

331. Electroanesthesia in Modern Anesthesiology. [illegible] S. [illegible] (Pacific Scientific Research).

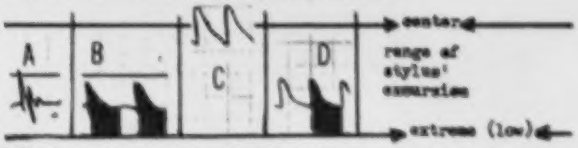
Electroanesthesia and hypothermia are the only forms of anesthesia that are not toxins introduced into the patient to produce a forced sleep or narcosis. Electroanesthesia acts primarily on pain perception. The patient is always able to see, hear, and is in general aware of his surroundings and may react to sharp sounds. Electroanesthesia is induced by passing an electrical current through the brain in the form of a low-frequency sine wave which is added linearly to a high-frequency sine wave from electrodes placed in various positions. This produces a rapid eye movement sleep without the usual signs of anesthesia with which the anesthesiologist is familiar. There are three major electrode placements. They are bitemporal, frontal-occipital, and oral-occipital with exact placement of the electrodes being critical. There are also three induction rates; they are slow, medium, and rapid induction, each with its advantages and disadvantages. The safety afforded by electroanesthesia when the operator is familiar with the equipment and induction techniques is great. The patient awakenes immediately when the output current control is turned to the "standby" (off) position.

332. The Embryo Considered As A Vector Field. CHARLES H. KLIPPEL, M.D. (Medical College of Ohio)

Lack of quantitation appears to be a source of unresolved problems in embryology and teratology. An investigation, still incomplete, indicates that growth and development may be better understood by reducing some aspects of embryology to a vector study, which in turn requires the selection of an appropriate set of axes. Topology states that there is a fixed point in every expanding system. Embryologic and dynamic considerations suggest that, in the human, such a "fixed point" lies near the middle of a line from the umbilicus to the second lumbar vertebra. Using this line as the X axis and its mid-point as the origin of a set of Cartesian coordinates with the Y axis in the mid sagital plane, the study was undertaken using existing embryologic material, enlarged photographically to a uniform 25 diameters. It was possible to draw a series of vectors which give the position and distance from the index point of a given anatomical feature at different times during the period of organogenesis. These vectors describe the "trajectory" of that feature, as it develops. The (vector) difference between two simultaneous vectors locating the opposite ends of a structure give the length and position of that structure. Thus far the study demonstrates that concepts of convenience found in most published embryologic material are misleading in the same way that epicycles were misleading in Ptolemaic cosmology. At present, the study is limited to structures close to the X-Y plane.

333. The Contribution of Wave Reflection to the Shape of the Pulse Pressure Contour. ANTONIO BOBA, M.D. (The Southern Illinois Clinic Ltd., Mount Vernon, ILL, 62864)

The Pulse Pressure Contour (PPC), as recorded via a 0.8 mm cannula in the brachial artery during intermittent closed chest cardiac compression in a patient dying because of exsanguination (A), is best explained in terms of propagation, reflection and dissipation of a pressure wave in a closed system(*). NOTE: connecting the upper reflection points and shading the subtended area yelds (B) an acceptable PPC, within the costraints of the curvilinear deformation of the recording system (#)(C, ordinary PPC with stylus at center of range of motion; D same PPC with stylus at one extreme). Observe that B and D are superimposable.



(*) Presumption of closed arterial system confirmed by other clinical data, not discussed here.
(#) Harvard Apparatus, galvanometer #350, writing arm's length 106mm, maximum stylus excursion at writing tip 50 mm.

IMPRESSION: Wave reflection, contrary to prevailing opinion may contribute to the shape of the pulse pressure contour.

334. Dermatoglyphic (Finger Print) Analysis of Early Onset Autism. DIANE SANK (Rockland Research Institute, Orangeburg, N.Y. and The City College, N.Y.) and BRIAN D. SANK FIRSCHEIN (Rockland Research Institute, Orangeburg, N.Y.).

Early onset autism is a severely debilitating psychiatric disorder of unknown etiology. It is usually detected by the age of two years though it may have a prenatal onset. Using two geographically distinct populations of autistic children, we compared the fingerprint ridge counts of male and female autistic children with data from childhood and adult schizophrenics and control populations. There were significant laterality and sex differences in ridge counts between the autistic and both adult and control populations, indicating autism has an organic etiology distinct from adult schizophrenia. The autistic group shared many dermatoglyphic traits with the childhood schizophrenics, suggesting that these two psychiatric conditions, generally considered separate entities, may be variations (in severity) of the same basic etiological agent(s). These data confirm and expand our earlier report showing fingerprint pattern frequencies and laterality preferences that differ between autistic and normal populations.

335-344 MEDICAL SCIENCES (METABOLISM) TUE., 14 FEB., 9 A.M./ SA CAUCUS

335. The Thymus Hypocalcemic Factor - Isolation and its Effect on Serum Calcium and Phosphate. BIRGIT E. NARDELL (University of Maryland).

A thymus hypocalcemic principle was isolated in a manner similar to calcitonin. Recent radioimmonoassay data indicates that this compound is not calcitonin. The isolation procedure involved four major stages: preparation of an acetone powder, the TCA powder, Sephadex G-75 and Bio-Gel P-6 fractionation and purification. Bovine thyroid and thymus tissues were used to check calcitonin activities since this material was originally thought to be thymus calcitonin. Elution patterns indicate that it may be a slightly larger molecule than calcitonin, presently estimated at 4,500 m. wt. Bioassay studies were conducted on all fractions using weanling and adult male and female Wistar rats. Samples were obtained via venous (jugular) injection of 0.5 ml test material and arterial (carotid) withdrawals were conducted at 15 minute intervals for 90 minutes. Thyroid calcitonin showed a reduction from 10 mg % to 7.5 mg %. The thymus factor in its purest form (150-200 MRCU/mg. peptide) decreased serum calcium to 6.5 mg. %. Phosphates paralleled calcium decreases. The thymus factor is most active in young animals; an observation which can be extended to changes in membrane receptors.

336. An Antifertility Mechanism for Copper Intrauterine Devices (CuIUD). C. D. ESKELSON (Arizona Health Sciences Center), R. L. MISIOROWSKI (Arizona Health Sciences Center) M. CHVAPIL (Arizona Health Sciences Center).

Human seminal amine oxidases (AO) are activated by copper ions. Copper IUD's incubated for 18 days at physiological pH's release enough copper into the media to activate the AO. These enzymes metabolize the polyamines normally found in high quantities in seminal plasma, producing products which are spermicidal. Sperm incubation systems containing Cu, dialized seminal plasma and one or more of the polyamines result in a rapid sperm death (as indicated by an inhibition of sperm motility). Putrescine, spermine and spermidine are all metabolized to spermicidal products in dialized seminal plasma containing copper. Apparently putrescine does not require copper for its metabolism to spermicidal products. However the addition of copper to a putrescine sperm-system causes sperm death even more rapidly. We believe there are at least 2 enzymes in seminal fluid metabolizing putrescine, one activated by copper, the other one not activated by copper. We conclude from these studies that the Cu activation of the AO in seminal fluid is an important antifertility mechanism of copper intrauterine devices.

337. Residues of Selected Organochlorine Pesticides in Human Adipose Tissue: Fiscal Years 1970-1975. F. W. KUTZ (Environmental Protection Agency), S. C. STRASSMAN (Environmental Protection Agency).

338. DDT as a Therapeutic Agent. RALPH [illegible] SHERMAN (Consulting Entomologist)

One of the early studies to test the effects of long-term occupational exposure to the insecticide DDT demonstrated the ability of DDT to stimulate enzyme synthesis in the liver of humans. This suggested to one investigator that DDT had therapeutic properties. Subsequent use of DDT in the treatment of unconjugated jaundice, which results from the inhibition of enzyme synthesis, resulted in the successful treatment of this disease. Other therapeutic uses followed. Case histories of selected medicinal uses of DDT are reviewed.

339. Influences of the Mineralotropic Hormones, PTH and CT, on Zinc Homeostasis. A. CHAUSMER, M. STEVENS and R. ZEARS. (Dept. of Medicine, Univ. of Texas Medical Branch, Galveston, Texas).

The potential influence of parathyroid hormone and calcitonin on tissue zinc homeostasis was investigated in the rat. $^{65}Zn\ Cl_2$ was injected intravenously into male thyroparathyroidectomized (TPTX) rats who had been pretreated with either parathyroid extract (PTE)(Lilly)-synthetic salmon calcitonin(CT). Control animals were injected with heat inactivated PTE or saline. Groups of 5-8 animals were sacrificed at various time intervals between 10 min. and 4 hours following ^{65}Zn injection and tissue and plasma specimens taken. Compartmental analysis tissue accumulation kinetics calculated. The effectiveness of the hormonal therapy was confirmed by significant differences in serum calcium concentrations. PTE induces a significant decrease in serum zinc ($P<.001$), while CT produced no significant changes. While CT had no effect on tissue zinc uptake in any tissue examined, PTE induces significant increases in uptake in adrenal gland, heart, kidney, liver, skeletal muscle, spleen and duodenum. No difference in compartmental models were noted between CT and Control, but PTE increased irreversible loss and significantly increased both influx and efflux fractional transfer coefficients approximately 30% over control values resulting in no net change in the cellular compartment size. This was confirmed by tissues stable Zn concentrations. It is concluded that PTH has a diffuse effect on cellular zinc homeostasis.

340. Interaction of Magnesium Deficiency with Tension Development and Mechanisms of Calcium Accumulation in K^+-Stimulated Rat Atria. MARY DANIEL HEALY, ORALIA TREVINO, NOEL REYES, and THERESA SPALDING (Incarnate Word College, San Antonio, Texas 78209).

A study was made of the effects of magnesium deficiency (MGD) on K^+ and Ca^{++} induced contractions of rat atria. Measurements were made of the effects on tension generation. ^{45}Ca accumulation studies were also undertaken as described by Van Breeman, C. et al (1972, Circ. Res. 30:44-54) and the total Ca concentration of the atria was determined by atomic absorption spectrophotometry. These investigations were made at 5-day intervals throughout a period of 40 days of MGD, which was induced by the feeding of a low Mg^{++} (4.5 mg/kg food) diet to the rats.

The data obtained indicate that there was a loss of magnesium from the atria throughout the period of study. The data also throw light on the hypothesis that magnesium and calcium either compete with each other for sites on the tissue membrane or that magnesium regulates the permeability of the cell membrane towards calcium. Supported by NIH Grant RR-08077.

341. **Effect of a Natural High Protein Intake on Calcium Metabolism in Man.** **HERTA SPENCER, LOIS KRAMER, DACE OSIS, and CLEMONTAIN NORRIS (Metabolic Section, Veterans Administration Hospital, Hines, Illinois).**

Several reports indicate that the intake of purified proteins induces a loss of calcium in animals and man. In the present study, several parameters of calcium metabolism were studied in adult males during a natural high protein intake which was due to a high intake of meat, keeping the total calorie intake constant in the control and high protein studies. The protein intake was 1 gm/kg in the control study and 2 gm/kg during the high protein intake. The intestinal absorption of calcium was determined with tracer doses of ^{47}Ca and the excretions of calcium in urine and stool and calcium balances were determined during the normal and high protein intakes. In only two of 16 studies did the urinary calcium increase during the high protein intake, however, the increase was only a temporary phenomenon and the excretions returned to control levels after 50 to 60 days of the continued high protein intake. The lack of change of the urinary calcium during the natural high protein intake is most likely due to the increased phosphorus content of this type of high protein diet used. The intestinal absorption of calcium, the endogenous fecal calcium excretion, and the calcium balances did not differ significantly during the normal and high protein intake.

Supported by USPHS grant DE-02486.

342. The Effect of Spontaneous Choice of Diet on the Course of Infection. M.J. MURRAY (University of Minnesota), A.B.MURRAY (University of Minnesota).

Previous observations suggest anorexia may play a role in mitigating the course of acute infection. The precise mechanism being obscure, we examined the choice of iso-energetic diets by infected mice and compared survival on favored diet with survival on less favored diets.

One group of 30 female Swiss-Webster mice of similar age and weight injected with 0.2 ml saline and another of 30 injected with an LD_{50} of Listeria Monocytogenes were offered a simultaneous choice of three iso-energetic diets of different % composition, P6,F20,C74, P6,F50,C44, P25, F35,C40. Mice were weighed and examined daily and their consumption of the diets measured. Infected animals uniformly selected low protein-low fat whereas healthy animals selected high protein-high fat diets. Three new groups of 30 animals were then infected with an LD_{50} and each given one of the three diets. They were weighed daily, their food consumption measured and their mortality rate and survival times determined. At similar energy intake animals on low protein-low fat had the lowest mortality (23%) and the longest survival (11.9 days) whereas animals on a high protein-high fat had the highest mortality (63%) and the shortest survival (5.3 days). Mice appear to be able to select diets favoring optimum survival during acute infection.

343. Dialyzable Leukocyte Extracts (DLE) Containing Transfer Factor (TF) Activity Exert Multiple Effects on Cellular Immunity (CMI) as Demonstrated by Leukocyte Migration Inhibition. G.B. WILSON and H.H. FUDENBERG (Medical University of South Carolina, Charleston).

Random migration of human polymorphonuclear neutrophils(PMN) is inhibited by a product of antigen(Ag)-stimulated lymphocytes called leukocyte migration inhibitory factor (LIF). We have used a modified LIF test under agarose (LMIA) to study the effects of DLE with TF activity on CMI in vitro. "TFd" denotes an activity in DLE from immune donors which can transfer specific CMI to previously non-immune recipients in vivo. Using DLE preparations with TF specific for PPD or coccidioidin and leukocytes from human subjects nonresponsive to both antigens, three effects were noted: 1) Ag-independent migration inhibition(MI), 2) Ag-dependent, SPECIFIC MI, and 3) Ag-independent enhancement of migration. The results show that the LMIA assay can be used as an in vitro test system to study those components responsible for specific TF activity. Complete separation of the components responsible for each effect was accomplished by gel filtration and ion exchange chromatography. Other results suggested that Ag-independent inhibition and enhancement of migration result from the direct effect of distinct components in DLE on intracellular levels of cyclic AMP and GMP, in PMN's. Ag-dependent MI results from the induction of

LIF secretion, from previously non-immune lymphocytes which have been incubated with appropriate DLE preparations or purified components plus antigen.

344. Epileptogenic Focus of Enflurane Anesthesia Identified by Autoradiographic Methods for Local Metabolism. ROBERT R. MYERS (University of California, San Diego, and Veterans Admin. Hosp., San Diego*), KENNETH F. RAY* and HARVEY M. SHAPIRO*

Electrocorticographic (ECoG) and depth recordings have previously demonstrated the epileptogenic nature of surgical concentrations of the volatile anesthetic, enflurane. We have employed the ^{14}C-2-deoxyglucose autoradiography method to quantify local cerebral metabolism in 20 brain structures in order to identify the epileptogenic focus. Autoradiograms were obtained from sectioned rat brain following a 30-minute period of steady-state anesthesia at 1, 1.5 or 2 MAC enflurane. At 1 MAC enflurane, regional cerebral metabolism was depressed approximately 30% from the awake controls. However, metabolism in the dentate gyrus of the hippocampus and the red nucleus of the midbrain was significantly increased. At 1.5 MAC, this dichotomy was maximal; at 2 MAC, metabolism was decreased in all structures. Pseudo-epileptiform ECoGs were obtained at 1 MAC where bursts of slow-waves and sharp-waves were evoked by peripheral sensory stimulation. At 1.5 MAC, the ECoG displayed frank epileptiform activity with large amplitude spike-wave complexes. Repetitive auditory stimulation occasionally precipitated grand-mal seizures. At 2 MAC, spikes were less frequent and could not be repetitively driven. We conclude that the low-seizure-threshold dentate gyrus is the epileptogenic focus for enflurane in the rat. The increased red nucleus metabolism is probably a manifestation of the motor involvement of generalized cortical spikes.

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345. The Amelioration, by Erythropoietin, of Amphotericin B Induced Anemia. R.B. REGGIO, T. NAPOLITANO, A. MUSHONGA and J. GURA (College of New Rochelle).

The use of Amphotericin B (AMB), in the treatment of systemic mycoses, is complicated by its nephrotoxicity as well as the induction of a moderate, albeit transient, anemia. It has been proposed that the anemia results from a suppression of red cell production. The present study suggests that the nephrotoxic effects of the drug and the suppression of erythropoiesis are related, presumably through a decrease in erythropoietin (ESF) production during therapy. Female albino rats (Wistar) were given AMB interperitoneally at a dose of 15 mg/kg for 5 consecutive days. Hematocrit, reticulocyte and radioiron levels were determined every 5 days for 15 days. When compared with controls, animals treated with the drug showed a marked decrease in each of the above. Recovery began with the cessation of treatment and continued throughout the 15 day period. The administration of Step I ESF (10U) eliminated the decrease in hematocrit and reticulocyte levels observed on day 5, and largely overcame the decrease in iron incorporation. The marrow, therefore, appears to remain responsive in the presence of the drug. Decreased ESF production, associated with the nephrotoxic effects of the drug, may then be the principal cause of AMB induced anemia.

346. Cardiovascular Degeneration in the Aging, Irradiated Mouse. S. P. STEARNER, V. V. YANG, E. J. B. CHRISTIAN and R. L. DEVINE (Division of Biological and Medical Research, Argonne National Laboratory, Argonne, Illinois 60439).

Cardiovascular degeneration in the B6CF$_1$ mouse has been studied through 24 months after irradiation. Radiation treatment, initiated at 4 months, included single total-body doses of 788 ^{60}Co gamma rad or 80 or 240 fission spectrum neutron rad, and fractionated total-body doses of 823 or 2390 gamma rad or 20, 80, or 240 neutron rad (24 fractions given in 23 weeks). Ultrastructural and in vivo microscopic observations revealed changes in the cardiovasculature, and functional studies showed that there were alterations in capillary blood flow. Degenerative changes in the myocardium and in the microvascular endothelium were present within 1-3 months. Coronary arteries showed medial degeneration, with accumulations of proteoglycans and debris; first seen at 1-3 months, these changes increased with age. Plaques within the intimal layer were present at 12-24 months. Similar but less extensive damage was present in subcutaneous and renal arteries. Degenerative changes, especially in coronary arteries, were more extensive after fractionated neutron irradiation than after comparable single doses. In contrast, fractionation of gamma irradiation reduced the resultant damage. Comparison of coronary artery damage after fractionated neutrons and gamma rays at the doses specified above indicates that the relative biological effectiveness (RBE) is in excess of 35. The RBE was approximately 3 for single dose neutron and gamma exposures. (Work supported by the U. S. Energy Research and Development Administration.)

347. Possible Inhibition of Norepinephrine Release by Lergotrile. TEYCHENNE, P.F., National Institute of Neurological and Communicative Disorders and Stroke, LAKE, C.R., National Institute of Mental Health, ZIEGLER, M.G., National Institute of Mental Health, PLOTKIN, C., National Institute of Neurological and Communicative Disorders and Stroke, CALNE, D.B., National Institute of Neurological and Communicative Disorders and Stroke.

Lergotrile is a dopaminergic ergot derivative with antiparkinson and hypotensive properties. Norepinephrine (NE) concentrations in plasma and cerebrospinal fluid (CSF) were measured in 12 patients with idiopathic parkinsonism, before and during lergotrile therapy. Other therapy remains unchanged. Patients were supine and at rest throughout. Pretreatment plasma NE specimens and BP measurements were taken from all patients; subsequently they received a single oral dose of lergotrile (mean 4 mg). When the maximum fall in BP occurred (at 1 to 3 hrs.) the next plasma NE sample was drawn. A third plasma NE specimen was obtained after the BP had returned to the pre-treatment level (at 6 hrs). The mean (± SEM) plasma NE concentration (194± 24 pg/ml) at the time of the maximum fall in BP was significantly lower than at pretreatment (235± 29 pg/ml) or 6 hours after (256± 49 pg/ml). CSF samples were analyzed from 8 patients, before and during lergotrile therapy (50 mg daily). Lergotrile induced a significant fall in CSF norepinephrine from 240 to 126 pg/ml These results suggest that one possible mechanism for the hypotensive action of lergotrile is inhibition of release of NE.

348. Xanthine Oxidase Carrying Liposomes, A Macromolecular "Trojan Horse" for Atherosclerotic Plaque Initiation. KURT A. OSTER and DONALD J. ROSS (Fairfield University, Fairfield, Conn.)

Studies of our own and others have reinforced the contention that xanthine oxidase (X.O.) in homogenized pasteurized bovine milk is absorbed catalytically active. The homogenization process creates liposomes which trap X.O. In this bioavailable form, X.O. can be phagocytized after entering the lymph stream and be released into target organs (arterial endothelium and myocardium). Resulting singlet oxygen damages the equilibrium of cell membrane phospholipids by oxidizing plasmalogen causing smooth muscle cell proliferation. Specific antibodies to bovine X.O. can be determined in human serum. Large pharmacological doses, 80 mg., of folic acid, a proven X.O. inhibitor and co-enzymatic restorer of fatty acid aldehydes needed for plasmalogen synthesis, inhibits the action of X.O. Applying the "Trojan horse" principle of liposomal enzyme passage through the intestinal barrier, a pathway is shown for the initiation of the original cell damage by a dietary component consumed in youth.

349. Comparison of Drinking Water Characteristics between two Communities with Significantly Different Blood Pressure Distribution Patterns.

EDWARD J. CALABRESE, (University of Massachusetts, Amherst) and ROBERT W. TUTHILL (University of Massachusetts).

A recently published study (Arch. Environ. Hlth. (Sept/Oct, 1977)) reported statistically significant differences in blood pressure distribution patterns between high sophomores (16 years old) from a community with elevated levels of sodium (100 mg/l) in drinking water as compared to sophomores from a similarly matched community with less than 10 mg sodium/l.

A follow-up study in which the characteristics of drinking water from the homes of representative participants as well as representative samples of the entire distribution system of each community in the original study were compared for 9 heavy metals which are known to affect the occurrence of cardiovascular function is presented. This study was designed to determine the presence (if any) of confounding variables with respect to drinking water characteristics which may affect the interpretation of the original study.

350. *Thrombocytosis Induced Supression of Acetylcholinesterase Positive Cells in the Rat Bone Marrow.*

MICHAEL W. LONG (Wayne State Univ. School of Medicine)

(1) Jackson,C.W.,Blood 43 (1973)413.

Rat bone marrow megakaryocytes are known to stain with a direct staining Acetylcholinesterase(ACh-E) stain. Also, there exists a population of small,less intensly staining cells which have been proposed as precursors of the Megakaryoblast (1). This paper concerns the results of a preliminary study in which the induction of thrombocytosis results in a significant supression in these small ACh-E cells. Thrombocytosis was induced by pooling the platelets from donor rats (15 per recipient) and giving this pool to the recipient intravenously. The donors were exanguated under ether anesthesia. Blood was collected in 3.2% Na-citrate under sterile conditions. The pooled platelets were concentrated by centrifugation and adjusted to a vol. of 1.0 ml. The final count of the pool being given was from 25-35 X $10^6/mm^3$. *Control animals were given 1.0 ml of sterile saline or platelet poor plasma(from the same donors). Thrombocytosis was monitored until a rebound thrombocytopenia occurred (7-10 days). Tibial marrows were stained and counted. The no. of small ACH-E cells were counted as the percent of Large ACh-E cells (based on 2,000 large cells/animal). The small ACh-E cells showed a significant reduction of >50%* ($p<0.05$). *This data would seem to support the concept that the small ACh-E cells are precursors of the megakaryocytic compartment.*

351.

THE ROLE OF PROPRANOLOL ON PLATELET AGGREGATION DURING EXPERIMENTAL TACHYCARDIA STRESS IN MAN.

J. Mehta, MD, P. Smedresman, MD, C. J. Pepine, MD. University of Florida, College of Medicine, Gainesville, Florida.

To evaluate the role of propranolol on platelet aggregation during tachycardia stress, twelve patients with documented coronary artery disease were studied. Blood samples were collected simultaneously from aorta and coronary sinus before, during and after pacing induced tachycardia. Platelet aggregation was assessed by Biodata aggregation profiler. In all patients, platelet aggregation was lower in the coronary sinus than in the aorta ($p<.01$) with ADP 1.0 μM and 2.0 μM addition. In five propranolol treated patients (group A) resting aortic and coronary sinus platelet aggregation was lower ($p<.01$) than in seven patients not on propranolol (group B). During pacing induced tachycardia, coronary sinus platelet aggregation increased from 17.0 ± 5.3% to 34.0 ± 11.1% ($p<.05$) in group A and from 42.2 ± 7.8% to 68.6 ± 9.3% ($p<.01$) in group B. Fifteen to 30 minutes after tachycardia, platelet aggregation returned to baseline levels in all patients.

These data show that platelet aggregation in coronary sinus blood is lower than that that in aortic blood suggesting possible consumption of hyperaggregable platelets in diseased coronary vessels. Propranolol lowers platelet aggregation at rest and prevents accelerated aggregation during tachycardia stress.

352. A Biopsychosocial Systems Model of Stress and Coping.

RONALD W. MANDERSCHEID (Mental Health Study Center, National Institute of Mental Health).

Recent theory and research hypothesize relationships among social structure, psychological and biochemical stress responses, modes of adaptation, and behavior. An empirically derived model is developed to link these variables within a single conceptual framework. In this model, structural stressors and structural, social, and psychological resources are viewed as countervailing forces that specify psychological and biochemical stress responses. Adaptation to stress, or coping, is conceptualized in two dimensions, the cognitive and the affective. Both serve to structure perception and, hence, behavior. The cognitive component also feedsback to inhibit psychological stress, while the affective component reduces biochemical stress. The former cybernetic loop permits experience to enter the psycho-biochemical system; the latter, natural biofeedback. An analysis of personal alienation serves to exemplify the model. Interventions to reduce the likelihood of negative coping strategies are discussed.

353. The Effect of Life Change Stress on the Human Immune Response[1].

S.E. LOCKE[2,3], J.S. HEISEL[3], R.M. WILLIAMS[3], and M.W. HURST[2].

Many physicians believe that there is a relationship between stress, emotions and susceptibility to illness. Experimental stress is capable of altering immune function in animals, but there is only a single prospective study on the influence of stress on cell-mediated immunity (CMI) in humans. To examine the relationship between psychosocial factors (PF) and immunity, we administered measures of life change stress (LCS) and other PF's to 114 subjects and then assayed natural killer cell activity (NKCA), a type of CMI. 88 S's were given a primary viral immunogen (A/NJ/76 influenza) and 26 S's received saline. Blood was obtained pre- and two weeks post-immunization. Results demonstrated that the baseline NKCA was negatively correlated with LCS reported for the prior year ($p < .05$). LCS had a significant inhibitory influence on the expected rise of NKCA following immunization for males ($p < .05$) but not for females, perhaps because the females' NKCA was not elevated two weeks after immunization. Further studies which will reduce interassay variability are in progress.

[1] Supported in part by McLean Hospital, Belmont, MA
[2] Boston University School of Medicine
[3] Harvard Medical School

354. Corticosterone Response to Stress in Individual Rats.

R. W. REYNOLDS, L. D. KEITH, and J. R. WINSLOW (University of California, Santa Barbara).

Plasma corticosterone levels were determined in individual male rats by a highly sensitive RIA technique. The sensitivity of this technique permits the use of plasma samples as small as 5 lambda, thereby permitting repeated sampling from a single rat at intervals as short as 15 seconds over a period of 15-20 minutes. The initial sample can be obtained as early as 15 seconds from the time of first handling of the cage. Since the handling, the minimal restraint, and the blood sampling represent a moderate stress, we have been able to follow the development of the resulting corticosterone response in individual rats. These studies have revealed several factors. First, basal levels of corticosterone may be as low as 1-2 ng/ml (0.1-0.2 μg/100ml) Previous studies, using other sampling procedures and less sensitive assays, usually report basal levels 50-100 times higher. Second, although there is a clear and dramatic increase in corticosterone starting at about 4 minutes, there is also an earlier low level response that occurs within 1-2 minutes, too early for mediation by ACTH. Third, a mild electrical shock at 10 minutes is followed in 1-2 minutes by an anomalous, precipitous decrease followed by an equally precipitous rise in corticosterone level. These observations suggest the existence of a mechanism for the rapid control of corticosteroid levels in addition to the slower ACTH regulation.

355. Clinically Useful SH Inhibitors Capable of Inducing Immunity Against Cancer in Mice.

F.KNOCK, R.GALT, Y.OESTER R.SYLVESTER (Augustana Hosp.,U. of Illinois, Loyola U.).

Selected SH inhibitors (SHI),active against a variety of human cancers clinically, can induce immunity against cancer in mice. Immunity has been induced against solid and ascites forms of S-180 and Ehrlich cancers. Histochemically, the SHI are seen to react mainly with protein-SH groups of cell surface, nuclear membranes and chromosomal proteins. From scanning electron micrographs, the SHI iodoacetate plus clinically useful adjuncts menadiol and heparin causes blunting of microvilli and changes of the texture of the cell surface of the cancer cells. In electrophoresis studies on chromosomal proteins, iodoacetate plus adjuncts reacts largely with nonhistone chromosomal proteins (NHP) especially those of higher molecular weight range, with much greater effect on NHP of HeLa cells than normal cells (Knock,F.,et al,Oncology,32:291,1975;Int. Surg.,61:287,1976). Studies to date underscore the need for more data on effects of such drugs on components of cell surface, microtubules and mitotic apparatus; on selected fractions of NHP, including DNA unwinding proteins, DNA and RNA polymerases and subunits; on activating effects of S Phase NHP subunits or of phosphorylated S Phase NHP subunits on DNA, RNA, histone and other protein synthesis; and on recognition of DNA subunits by NHP subunits. Such data on normal and cancer cells can be expected to accelerate design of improved antitumor agents and understanding of mechanisms of oncogenesis.

356. Anomalies in Lung Cancer Mortality Rates for White Males Along the Atlantic Coast of the Southeastern U.S.A.

Y. C. PARK (Department of Statistics, Florida State University), F. W. LEYSIEFFER (Department of Statistics, Florida State University) and J. W. WINCHESTER (Department of Oceanography, Florida State University).

Published 1950-1969 age adjusted lung cancer mortality for white males in U.S. counties indicates higher than average rates in portions of the Southeast. We have examined the statistical significance of these rates by hypothesis testing methods, regression equations, trend analysis, and other procedures and conclude that: (1) coastal Atlantic counties have significantly higher rates than nearby inland counties of Florida, Georgia, and South Carolina; (2) the differences are significant for nonurban as well as urban counties; (3) the greatest rates in both coastal and inland counties occur in the vicinity of the Florida-Georgia state line. The coastal anomaly suggests the presence of a maritime causal factor, but the higher rates found near the Florida-Georgia line compared with more southerly counties suggest the presence of additional factors as well. The interaction between fine particulate air pollution, transported on a mesoscale from eastern U.S. sources, and chemical properties of the semitropical maritime atmosphere is greatest in the region of greatest lung cancer mortality, suggesting a causal connection.

357. The Relationship Between Transformation and Somatic Mutation.

D.A. SPANDIDOS and L. SIMINOVITCH (Dept. of Medican Genetics, Univ. of Toronto, Toronto,Canada M5S 1A8)

A morphologic transformation assay has been developed using primary Chinese hamster cells. Transformation frequencies with the carcinogens benzo(a)pyrene and urethane were found to be at the levels of 8 and $2x10^{-3}$ morphologically transformed colonies/total surviving colonies respectively. Attempts to transform primary human lung cells with the above carcinogens was unsuccessful indicating a frequency lower than $0.2x10^{-3}$. The frequency of spontaneous and carcinogen-induced mutations to 6-thioguanine resistance (TG^R), ouabain resistance (oua^R) and fructose utilization($fruc^+$) was also measured in Chinese hamster and human lung cells. Mutation frequencies were found to be 10-15x higher after treatment with benzo(a)pyrene and 3-7x after treatment with urethane. Moreover in both cell systems the frequencies of mutations for each marker were within the same order of magnitude (ca 10^{-6}-10^{-7}). The spontaneous rate of mutation to TG^R in the two cell systems was also similar. Two conclusions can be drawn from these results. First, the frequencies of transformation in hamster cells are much higher than frequencies of mutagenesis. Secondly, the processes involved in primary carcinogenesis in vitro in hamster and man must differ in a fundamental way.

358. Lymphoid Induced Neovascularization; A Biphasic Phenomenon.

MICHAEL E. PLISKIN (University of Pennsylvania).

Tumor induced neovascularization has been demonstrated in a variety of systems utilizing intact tumor cells or a factor derived from tumor cells. However, the induction of neovascularization may not be exclusively a property of tumor cells. For instance, there is sufficient evidence suggesting that "sensitized" lymphoid cells show a dose dependent stimulation-inhibition of tumor and normal tissue growth. On the basis of this I predicted that phytohemagglutinin (PHA) activated spleen cells would show a dose dependent stimulation-inhibition of neovascularization. To test this hypothesis BALB/cByJ spleen cells were cultured for 24 hrs. with or without PHA, washed 3x in media, viable cells counted and appropriate dilutions made. The spleen cells were injected intracutaneously into syngeneic recipients which had been irradiated (800R whole body) 24 hrs. previously. Three days later the mice were killed and the number of blood vessels surrounding the injection site were counted. It was found that 2×10^5, 5×10^5 and 1×10^6 PHA activated spleen cells caused a significant increase in the average number of blood vessels as compared with controls. However, at a concentration of 4×10^6 there was a highly significant inhibition of neovascularization. These results may suggest a partial explanation for the immunostimulation of tumor growth at low levels of tumor immunity and for tumor growth inhibition at higher levels of immune reactivity.

359. Mouse Cancer Cures with Isocyanates.

GILBERT MOOS (State University College, Fredonia, New York 14063) CALVIN ASTRY, NOAH BARNES, GREGORY BURROWS, NANCY COOPER, ROBERT COURTOX, EDWARD LIN, JOHN MAQUIRE, BRIAN McCARRON, BARBARA PHILLIPS, EARL STEELE, and MAY YU (all SUCF).

We evaluated the effects of isocyanates, a new class of cancer inhibitors (Moos, G.E. et al: Cancer Res. 31, 937 (1971), on survival times of Swiss mice carrying Ehrlich ascites tumors. We inoculated the mice intraperitoneally with 10^7 Ehrlich ascites tumor cells each. One day later, we began treatment by injecting an isocyanate dissolved in peanut oil. We evaluated many isocyanates, dosages, and injection schedules. We obtained best results with hexamethylene diisocyanate and 3 or more treatments, based on mouse weight changes, of 12 mg/kg/day. We obtained increases in survival times of $>$ 200% and up to 40% cures. Approximately half of the cured mice became immune as a result of the isocyanate treatments, for they survived longer than 50 days without evidence of the disease following a transplantation of fresh tumors without subsequent isocyanate treatment. The achievement of cures should moderate the objections of some people toward the use of peanut oil as an injection vehicle. The development of immunity represents progress toward potential future immunological control of cancer.

360. Hormonal Characteristics of Long-Term Cultured Breast Carcinoma Cells.

Anwar A. Hakim (Departments of Surgery, Physiology and Biophysics. Division of Surgical Oncology. Univeristy of Illinois at the Medical Center. Chicago.Ill.

Enzymes, trypsin and collagenase have been used to detach cultures cells for tranfers and subcultures. Success has been attained with cell cultures of animal origin, but with human cell cultures, the technic yielded cultures which grew few months then became non-viable. Using media containing high levels of fetal calf serum(FCS) alternating with alpha-1-antitrypsin(AAT) it was possible to culture human breast carcinoma cells for periods longer than 18 months. The culture medium consisted of Eagle's essential medium (MEM) containing penicillin (100 IU/ml), streptomycin (100 ug/ml), glutamine 3 mM and insulin (1 IU/ml) supplemented with 50% FCS alternating with 10 ug/ml of human AAT. The medium was changed every 72 hours. Under these conditions, and within 5 to 15 days after the explants adhered to glass, multinucleated pleomorphic cells which in 10 to 12 weeks formed clusters and foci which overlapped, piled and frequently formed solid masses. Subculture was attained by carefully detaching and transferring few of these foci to new culture bottles. Cytological, histological, karyotype and electrone microscopic examinations confirmed the cultures as human mammary epithelial carcinoma. All the cultures responded to hormonal stimulation. The data indicate correlation between estrogen synthesis and levels of estradiol binding receptors at the surface of the human breast carcinoma cells.

Virus-Induced Diabetes Mellitus: Replication of Coxsackie B-3 Virus in Human Pancreatic Beta Cell Cultures. J.W. Yoon, T. Onodera, A.B. Jenson, and A.L. Notkins. NIH, Bethesda, Md.
361.
Seroepidemiologic studies have suggested that Coxsackie B viruses might be involved in the etiology of some cases of juvenile-onset type diabetes mellitus. In the present experiments, an in vitro model for culturing human pancreatic beta cells was used to test the capacity of Coxsackie virus B3 to infect insulin containing beta cells. Antibody to Coxsackie virus B3 was labeled with fluorescein isothiocyanate and antibody to insulin was labeled with rhodamine. By use of the double-labeled antibody technique three populations of cells were identified; uninfected insulin-containing beta cells which stained only with rhodamine-labeled anti-insulin antibody; Coxsackie-infected (non-insulin-containing) cells which stained only with fluorescein-labeled anti-Coxsackie antibody; and Coxsackie-infected insulin-containing beta cells which stained with both antibodies. Examination of the cultures for infectious virus revealed the highest titer at 72 hr after infection. Radioimmunoassay for insulin showed that the intracellular immunoreactive insulin levels decreased rapidly beginning at 24 hrs after infection. These studies show that under in vitro conditions, human beta cells are susceptible to Coxsackie virus B3 and that the infection results in destruction of beta cells and release of insulin.

362. A New Muscle Disease: Myo-Adenylate Deaminase Deficiency. W.N. FISHBEIN, V.W. ARMBRUSTMACHER & J.L. GRIFFIN (Armed Forces Institute of Pathology, Washington, D.C.)*

Application of a new histoenzymatic stain to frozen muscle biopsies has uncovered a new and probably common disease of muscle. Four WM patients, ages 11, 19, 23 & 31 have been identified in a series of 200 biopsies. All had muscle weakness or post-exercise cramping, and 3 had elevated creatine kinase (CPK). Histochemical stains showed no pathology (3 cases) or mild Type I atrophy. The adenylate deaminase (AMPDA) stain was negative, and solution assay of homogenates revealed 1% the AMPDA of 9 controls. In contrast, levels of adenosine deaminase (ADA) and CPK were normal. Mixtures of deficient and normal samples displayed no inhibition. Histograms showed an increased spread or a low incidence of IIB fibers. Blood samples from two patients showed normal levels of RBC AMPDA (& ADA), suggesting that the RBC isozyme is under separate genetic control, and may play a crucial salvage role in this disease. AMPDA is very high in skeletal muscle, is responsible for ammonia production during work, and may keep ATP/ADP ratios high and synchronize contraction with glycolysis. While diagnosis requires AMPDA assay on a muscle biopsy, a simple sponge-squeezing test may provide a clinical indicator. In the one patient tested, increase in plasma ammonia after exercise, relative to lactate, was 5x lower than controls. This disease may account for many cases of nonprogressive myopathy, limp-infants, and benign congenital hypotonia.

*Supported in part by NIH Grant AM10960

363. A Note on Dichotic Listening in Parkinsonian Patients. FLORRY P. BOWEN, JANET LEVY, EDOUARD VISICH AND HARRY SMITH. (Bronx VA and Mt. Sinai Med. Center)

Striatal mechanisms affect hemispheric specialization. However, some of the same limitations exist as in studies with cerebral cortex injury, namely; I. variable approaches in categorization of subgroups, 2. lack of uniformity om defining handedness 3. comparison of data at different developmental levels.

The dichotic listening test was administered to 60 R handed parkinsonian patients and 18 controls, matched for age and sex, who received audiometry as well as the WAIS Verbal IQ, Wechsler Memory Test and a tapping test. An analysis of covariance revealed that parkinsonian patients do not differ in their ability to recall digits. They do recall significantly less words presented to the right ear, but not to the left ear. Levodopa improved the right ear dominance effect moderately, but had a signi-effect on bimanual tapping. The role of selective attention in relation to language and motor function are considered. It is postulated that inadequate modulation of the right hemisphere could interfere with normal development of speech.

Supported by Clin. Center for Res. on Parkinson's Disease and Allied Diseases 3P50NS11631.

364. Endoneurial Pressure in Peripheral Neuropathy. ROBERT R. MYERS (University of California, San Diego* and Veterans Administration Hospital, San Diego), HENRY C. POWELL* and BENJAMIN W. ZWEIFACH*

Elevation of endoneurial pressure has been suspected in certain peripheral neuropathies in which edema of nerve tissue develops as a result of cytotoxic injury or is caused by a permeability alteration of the blood-nerve barrier, but in vivo measurements have not been feasible until recently. We have applied the active, servo-null, micropressure system originally designed for measurement of hydraulic pressures in the microcirculation to quantify in vivo endoneurial pressures. Rat sciatic nerve pressures were measured in hexachlorophene neuropathy, Wallerian degeneration secondary to crush injury and controls. The essence of the pressure system is a glass micropipette (4 micron tip diameter) filled with 1 molar saline which is inserted directly into the nerve at the time of recording. Electrical resistance of the pipette is altered by intrusion of physiologic fluids of different conductivity at the pipette tip by endoneurial hydrodynamic forces. A counter-pressure is generated through the pipette to minimize the resistance error signal. This is taken as the in vivo nerve pressure. Nerve disturbance is minimal since only the pipette tip is inserted into the nerve. Control pressure was 2.04 ± 1.02 cmH2O. The endoneurial pressure of rats exposed to hexachlorophene in their diet ranged from 4.8 to 17.0 cmH2O. Pressures in Wallerian degenerating nerves ranged from 4.2 to 7.3 cmH2O. Peripheral nerve morphology was correlated with endoneurial pressure values in each animal.

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365. Cost benefit analyses of substance abuse programs - the economic implications of recidivism and resource absorption. ALEX RICHMAN, M.D. (Mount Sinai School of Medicine, New York).

A minority of patients absorb a disproportionately large volume of treatment resources; about 4% of alcoholics account for 24% of the detoxifications reported in NIAAA funded alcohol treatment centers. In addition to resource absorption, there is marked recidivism - readmission rates progressively advance for persons with increasing numbers of previous admissions. Recidivism and resource absorption have major implications for cost benefit analyses. Longitudinal evaluations of outcome for a defined group of treated patients often ignore recidivism or resource absorption.

Treatment programs, which may be highly effective, can also have high recidivism or resource absorption by a minority of patients. The resources of such programs can be increasingly absorbed by persons for whom previous treatment has been ineffective, and the program is less able to accept those new patients for whom treatment is effective.

In some alcohol detoxification programs about one-half of patients do not return for additional treatment; social and economic benefits predominate in this group. The minority of patients with repeated admissions show less social and economic benefit. The future costs of readmissions for the minority must be related to the benefits for those with only 1 or 2 admissions.

Cost benefit estimates which ignore resource absorption or recidivism will minimize the cost of the programs and exaggerate their benefit.

366. Dependence of Probability of Influenza Epidemic on Severity. CLIFFORD J. MALONEY (Bureau of Biologics, FDA).

Incidence of influenza mortality shows a pronounced seasonality. In addition annual totals as measured by July to June death totals vary greatly from year to year. Monthly death counts for the period 1950-1975 are available from the National Center for Health Statistics, USPHS. The annual (July to June) mortality totals ascribed on the death certificate exclusively to influenza varied from 1034 to 9522 deaths. More deaths are believed caused indirectly by influenza, chiefly pneumonia. The available data were used to develop a frequency distribution of annual influenza mortality incidence. The probability of an "influenza epidemic" is shown to depend critically on the definition of "epidemic". In particular, while a recurrence of the 1918 pandemic is highly unlikely, that level of severity is assigned a low but not negligible probability.

367. The Role of the Physician in the Obstetrical Decision Making Process. LEWIS E. MEHL, and THYA MERZ (Institute for Childbirth and Family Research, Berkeley, California).

368. Attitudes and Experiences of College Women Regarding Pelvic Examinations. LEONORE TIEFER (Department of Psychiatry).

254 women college students responded to a mailed questionnaire asking about their experiences with pelvic examinations and those aspects they like and dislike. The results indicated that most college women have had pelvic examinations for nonmedical reasons, that many do not understand what the physician does or why such exams are needed, that most but not all sexually active women have regular pelvic examinations, and that there are no differences in attitude between heterosexual and homosexual women on this subject. Some women clearly prefer a consultation situation where they play an active, information-seeking role whereas an equal number of women prefer to be taken care of by a kindly, competent physician who does not bother them too much with the factual details.

A controversy rages in the contemporary ob-gyn literature about the attention and concern given to women's illnesses and health-information needs; the self-health movement attests to a sizable rejection of traditional medical attitudes and techniques. The current study contributes information useful for effecting a rapprochement between the interests of the dispensers and the consumers of "well" gynecological care.

369. The British National Health Service: Some Major Shortcomings Generally Overlooked. DONALD H. PURETZ (SUNY:Dutchess Community College), SUSAN L. PURETZ (SUNY:New Paltz).

While sometimes admitting to relatively minor shortcomings in the British system of socialized medical care, most authors of the subject have been almost uniformly positive if not glowing in their analyses of its effectiveness. This was not the finding of this presentation's authors. Based on their 3 week on site study of the NHS, with the assistance of health ministry employees and health practitioners, the authors found numerous major shortcomings in the system. These relate to areas of philosophy, planning, administration, evaluation, implementation and results. Their identification and summary is the aim of this slide presentation.

370. Improving Compliance of Hypertensive Patients. Marjorie J. Powers, Ph.D. (University of Illinois at the Medical Center, College of Nursing, Chicago, Illinois.)

The objectives were to develop techniques for the education and motivation of hypertensive patients and to evaluate the relative effectiveness of different approaches. Approaches were designed to include both educational and behavioral strategies. The level of fear arousal, the directiveness of the approach, the extent of patient participation, and the number of follow-up visits were manipulated. Dependent variables included blood pressure reduction, appointment keeping behavior, evaluation of knowledge, attitudes and compliance, along with nurse evaluation of goal attainment of specific goals. One hundred sixty diagnosed hypertensives made up the experimental group; sixteen patients were selected for a pure control; thirty-three patients who meet the criteria for the study but who could not participate constituted a chart review comparison group. Data analysis of the dependent variables involve several distinct stages: (1) descriptive analysis of the distribution of each dependent variable; (2) before-after experimental analysis of changes in dependent variables; (3) comparison group analysis of experimental and control groups; (4) multi-variate hierarchical regression of the dependent variables on selected antecedent variables. Initial findings indicate that patients attending the hypertensive education program average blood pressure reduction which were both statistically and clinically significant.

371. A Method for Rapid Evaluation of Tests for Carrier Detection in Genetic Diseases. S. ROSENBERG, M. AST, E. METZIG (Bernard W. Schlesinger Foundation, New York).

The authors propose a new research strategy for rapid evaluation of predictive tests in a wide range of genetic diseases. Huntingtons disease (HD) is chosen to illustrate how the method works. HD usually begins between 25 and 50 years of age. At birth, children of patients have 50% risk; however, asymptomatic offspring over 50 (called "escapees") have a 0-20% risk, i.e. 0-20% are gene carriers. At present evaluation of test-effectiveness requires two stages: (a) the test must yield 100% positive responses (R+) in HD patients, and 50% R+ and 50% R- in young offspring at-risk for HD; followed by (b) 10-25 or more years of follow-up to confirm predictions. To date, no test which has fulfilled (a) has also satisfied (b). The authors' new method enables preliminary evaluation of predictive tests prior to follow-up. Not only HD patients and young offspring, but also older "escapees" (0-20% carriers) must be tested. Results with EEG testing show that ineffective tests yield 50% R+ and 50% R- in both groups of offspring, the young at-risk offspring and the "escapees." An effective test would yield the following distribution: (1) patients: 100% R+; (2) young at-risk offspring: 50% R+; and (3) "escapees" 0-20% R+. This methodology might be useful in eliminating ineffective tests without the need for decades of longterm follow-up. This research strategy is applicable to a wide range of other genetic diseases, from breast cancer to schizophrenia, where an "escapee" group can also be tested.

372. Some Effects of an MCH-Family Planning Clinic on Indian Reservations of the Northwest. A. FOSTER, (USPHS) and J.R. GOORMAN, (USPHS)

This inquiry examined some effects of an MCH-Family Planning Program begun in 1971 in some Northwestern Indian Reservations.

All birth certificates for reservation-based Indians of the Northwest, 1969-1974, and 184 matched infant death certificates, were reviewed for a number of characteristics including age of mother, birth order, legitimacy of child, mother's age, previous pregnancy history, and birth weight. The information was sorted by reservation according to presence or absence of an effective MCH-FP clinic.

Where an MCH-FP clinic was present, there was a sharp decline in the number of mothers over age 35, mothers with five or more children, a significant decline in the low-birth weight and neo-natal mortality rates.
As a program with relatively clear objectives and priorities, the MCH-FP clinics on the Indian Reservations seem to have achieved their purpose by arranging time according to priorities, by the enlistment of community support, and the maintenance of professional involvement in support of its overall goals.

373. Modeling Optimal Human Diets.

JOSEPH L. BALINTFY (University of Massachusetts).

A mathematical model has been formulated and tested that is capable of optimizing food choices and menu plans while meeting any desired nutritional and budgetary specifications. The approach is based on the analytical definition of food preferences as concave unimodal functions of eating frequencies. Preference and frequency attitude surveys were developed for a quadratic approximation of these functions. The resulting expression combined with food nutrient, menu structure, and food cost constraint data is adequate to represent the optimal human diet problem in the form of a quadratic programming model. The model has been verified by planning school lunches in two school systems. Double blind plate waste experiments established that the optimal school lunches increased participation and food consumption significantly while reducing plate waste and food cost as expected. Parametric analysis of the model can provide the preference efficiency, i.e., the hedonic value of any budgetary, nutritional or structural limitations imposed on the diet. This property makes modeling an ideal tool, not only for optimal diet planning, but also for nutritional policy making decisions. The model has universal applicability for any institution, expert or individual with access to reliable data and a computer.

374. Health Care Consumers' Utilities for Service Attributes.

CARL NELSON (Northeastern University), LAWRENCE H. WORTZEL (Boston University), ROBERTA CLARKE (Boston University).

Consumer satisfaction is becoming recognized as an increasingly important component in health care delivery. This study explores health care consumers' utility evaluations of different levels of several managerially influencable service attributes connected with health care delivery (such as waiting time, encounter time, staffing mix and fee) as a function of some underlying attitudes toward health and health care. The methodology used is trade-off analysis. This technique takes subjects rank orderings of pair-wise combinations of attribute levels and finds an underlying interval valued property function for each attribute. The study focuses on pediatric visits for both acute and preventive care.

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375. Visual Preference for Five Natural Landscapes.

JOHN D. BALLING (Smithsonian Institution), JOHN H. FALK (Smithsonian Institution).

This study assessed the visual preference for five different biomes--tropical rain forest, deciduous forest, conifer forest, savanna, and desert. Four slides, all taken under standard conditions, were shown to approximately 600 people residing in Maryland and including third grade children, sixth grade children, high school students, college students a group of professional foresters, and a group of senior citizens. Each subject viewed the slides twice and gave a preference rating on a 6-point scale. On one pass through, the viewers rated the slides according to how much they would like to *live* in an area similar to the one depicted, disregarding all economic, social, and cultural considerations. On the other pass through, they judged each slide for how much they would like to *visit* such an area. The overall order of preference for the biomes was savanna > deciduous forest > conifer forest > rain forest > desert. Age was inversely related to preference for all biomes. Multivariate statistics were performed to further analyze the dimensions used in making judgments. The results were interpreted in terms of Man's evolutionary history and his cultural adaptation in various landscape types.

376. Childhood Depression, Learned Helplessness and Locus of Control.

MONROE M. LEFKOWITZ and EDWARD P. TESINY (New York State Department of Mental Hygiene).

The present study examined the relationship between depression, learned helplessness, and locus of control (external or internal) in childhood. Data collected from 188 4th and 5th grade normal elementary school children included peer nominations and self ratings of depression in addition to data from teacher ratings, pupil personnel records, and census tracts. Results revealed a significant relationship between locus of control and depression: children who perceive the control of reinforcement as external are more depressed. Externals were found to have low self esteem, low school achievement scores, poor social behavior, and tend to come from larger and lower income families. A factor analysis of the depression measure produced three factors: lack of ebullience, inadequacy, and dejection. When factor scores were correlated with other variables, the inadequacy factor accounted for a major portion of the significant covariation. The present study supports and extends data bearing on the relationship between locus of control and depression in adults. Results suggest that externality, the perception of a noncontingent relationship between response and consequence, may underlie both learned helplessness and depression.

377. Behavioral Studies of Young Children Isolated in a Germ-Free Environment.

ALBERT R. HOLLENBECK and ELIZABETH J. SUSMAN (National Institute of Mental Health).

The deleterious effects of separation in childhood have been demonstrated in experimental animal studies and in naturalistic observational studies of children. Recent studies on monkey mother-infant separation have demonstrated that physiological changes occur in the infant almost immediately after separation from the mother. Behavioral signs of clinical depression emerge later. The use of Laminar Air Flow rooms to provide germ-free therapeutic environments offers a unique opportunity to study human mother-child separation in a natural context. A 3-year-old girl and a 3½-year-old boy were each placed in Flow for a 6 week period while undergoing chemotherapy for malignant tumors. Research questions focused around mother-child separation during therapy. (1) How does separation *per se* influence observable behaviors (e.g., play)? (2) What are the physiological concomitants of separation? (3) Are there cumulative psychological effects due to separation (i.e., prolonged bouts of anxiety or depression)? Physiological changes include drop in body temperature 24-48 hours after separation. Behavioral data indicate that positive behaviors such as play tend to decrease. The child becomes progressively passive over the period of separation. Both qualitative and sequential changes in behavior related to the course of illness and treatment will be discussed.

378. The Development of Competitive Behavior as a Function of Culture, Age, and Social Comparison.

CHARLES G. McCLINTOCK (University of California), FRANK J. STECH (University of California).

The choice behavior of second, fourth and sixth grade children from five different cultural backgrounds was observed in the maximizing difference game, an interdependence task where individualistic and cooperative motives were placed in opposition to competitive ones. In four of the cultures children received either social comparison feedback or only information concerning their own cumulative scores. As predicted, the level of competitive responding increased with age, social comparison information, and trials. Systematic cultural differences obtained. A newly developed covariation analysis provided descriptive measures of the magnitude of the main effects and the various significant interactions, and revealed that individual dyad variation accounted for more covariation than the main effects and interactions. Hence, further analyses were performed to determine sources of dyadic variation as a combined function of the response patterns of individual dyad members and culture, age, and display. Finally, cultures were classified in terms of the characteristic play by dyad members, and the results compared with Mead's classifications in which she ordered the cooperative, competitive and individualistic orientations of members of thirteen "primitive" societies.

379. The Development of Graphic Representational Skills. S. FARNHAM-DIGGORY (University of Delaware).

The ability to draw simple geometric forms (square, triangle,diamond) is an index of development. Typically, a 5-yr-old can draw a square, but only a 7-yr-old can draw a diamond. Why? What capacities must a child have in order to reproduce simple geometric figures? Videotapes were made of children's eye- and hand-movements during pattern drawing. Analysis of the microstructure of the data showed that (a) children alternate tracking (to target held by eye) with hand-watching, averaging 500 msec/track, and 1000 msec/watch; (b) watching one's own hand may be how one learns to mentally represent graphic trajectories; and (c) eye movements at critical drawing points may index the activation of particular concepts — e.g., the concept of symmetry. These are all mechanisms of skill development which can be studied by slow motion videotape techniques.

380. Mental Health in Children - Pivital Role of Intelligence. D.V. SIVA SANKAR (Queens Children's Psychiatric Center, Bellerose, N.Y. 11426).

We have previously postulated hypotheses of Multithemic Etiology (MTE) and Comprehensive Profile Based Therapy (CPBT) in Child Psychiatry (cf. Mental Health in Children Vol. I to III, Westbury, PJD Publications, 1976). However, one factor is of most considerable significance in child psychiatry. This is the I.Q. of the child. Our research on about 5000 children shows that the child with the lower I.Q. is brought at a younger age for consultation, hospitalized longer, more difficult to treat by conventional methods, comes from a larger family and is of a higher ordinal number among siblings. Further, children from broken families are not necessarily hospitalized longer than children from intact families. These inferences signify (a) A significant involvement of I.Q. in what we call childhood schizophrenia; (b) Separation of child mental health and mental retardation facilities can be costly to the taxpayer; and (c) Treatment plans for such children should include prevocational training and therapeutic modalities to primarily enhance intellectual abilities.

381. Automated Instrumentation for Obtaining Lingual Vibrotactile Thresholds from Children. KAL M. TELAGE, PH.D. (School of Allied Health Professions, Ithaca College)

The paper reviews the importance of the tactile sensory system as an element in the speech feedback network. Early diagnostic instrumentation is compared to recent modifications in hardware and measurement procedures which provide greater ease and flexibility for assessing lingual vibrotactile sensitivity in young children. A discussion emphasizes the rationale for early assessment with high risk children and focuses on current basic and clinical research in this area. .

382. Verbal Memory in a Chimpanzee (Lana). Timothy Gill (Yerkes Regional Primate Research Center), James Buchanan (University of Scranton), and John Braggio (University of North Carolina at Asheville).*

Basic research procedure: Yerkish word lists were presented sequentially every 2-3 secs. followed by immediate free recall by Lana. Lists were randomly drawn from 3 types of words (12 object, 8 color, & 15 food-drink). In phase 1, Lana was given 30 trials each on list of 1-8 words with items in a given list of one type. Serial position curves yielded both primacy and recency effects for 4 to 8 item lists ($\bar{X}$% recall 4-8 = 85% first, 95% last, & 67% intermediate positions). In phase 2 Lana was given 60 trials on 9 word lists of 3 words from each word type with each category every third word. An ARC analysis of clustering (0 = chance 1 = perfect clustering) revealed that Lana tended partially to organize her recall (ARC = .21, trials 1-30; and .45 trials 31-60) either on the semantic categories and/or on a totally confounded perceptual categorization of color of the symbols. Only 34 intrusion errors over 300 trials indicate that Lana's performance was not the result of chance guessing. The findings will be discussed in terms of human developmental research in verbal memory and the implications for the primate language projects and information processing theory.

*The intial conceptualization of the research design is that of the second author. The first two authors share equally in the authorship of the paper.

383. Piagetian Analysis of Juvenile Chimpanzees. JOHN T. BRAGGIO (University of North Carolina at Asheville), JAMES P. BUCHANAN (University of Scranton), ANTHONY D. HALL (University of North Carolina at Asheville), and RONALD D. NADLER (Yerkes Regional Primate Research Center).

Thus far, it has not been shown that nonhuman primates can use both color and shape cues to solve problems. To assess this capacity, a nonverbal Piagetian-type multiple classification task was administered to 3 male and 3 female juvenile chimpanzees (Pan troglodytes) having an average age of 5.5 years. On each of the 450 unique problems presented, the subject was required to select one of four stimulus objects and place it in an empty cell of a 2 by 2 Plexiglas matrix. Analysis of first-trial performance indicated that, while there were no sex differences or dimension preferences, all six chimpanzees could reliably solve the problems by selecting stimulus objects that were correct on both color and shape dimensions. These data clearly show that juvenile chimpanzees, like human children, can use two stimulus dimensions to respond correctly on a Piagetian-type multiple classification task, thereby suggesting a similarity in the cognitive capacities of human and nonhuman primates. The possible use of Piagetian theory and methodology to assess the cognitive capacities of other nonhuman primates, in addition to chimpanzees, will be discussed.

384. Patterns of Chimpanzee (Pan troglodytes) Gaze Behavior During Sign Language (ASL) Conversations. Roger S. Fouts, Ph.D. (University of Oklahoma), Diana L. Davis, (University of Oklahoma).

Patterns of chimpanzee gaze behavior were studied during dyadic, ASL (American Sign Language of the Deaf) conversations with a human companion. The context of the interactions occurred in a food begging situation; only one member of the dyad, the human companion, was in possession of fruit or beverage. Both chimpanzee subjects were females which differed in age and proficiency in ASL. The conversations were recorded on video tape and analyzed with regard to the occurrence of a gaze preceding, during, and terminating a sign or group of signs. A pattern of gaze behavior was found to occur during discourse. The most frequent direction of gaze preceding the onset of a sign or group of signs was as follows (ranging from most frequent to least frequent): towards the fruit or beverage, towards the eyes of the human, and looking away. The results are discussed in terms of the significance to natural chimpanzee communication, gaze behavior in humans, and the evolution of language behavior.

385. The Hereditary Genius of American Presidents. PHILIP HOWARD GRAY (Department of Psychology, Montana State University, Bozeman, Montana 59715).

It has been upward of a century since Francis Galton showed that scientific genius is inherited. The present study applies this reasoning to political genius and the American presidency using genealogical methods and knowledge developed since Galton's time. With few exceptions, American Presidents have been of British background, typically from English and Scottish families with genetic links to the ruling aristocracies. Using royal descents as a genetic trace element the interrelationship of the American Presidents is examined. The most effective Presidents appear to have been those with the strongest genealogical connections to the Viking race that conquered parts of France, Italy, Russia, Asia Minor and eventually all of England, Scotland and Wales. (No connection to the Greek and Roman ruling class has been found.) The genetic funnel was made of up about a hundred Protestant families settling early in Virginia and New England. No President has been from the working class. Few Presidents are without extensive genealogical roots in America. Since World War II, Democrat presidents have been from families of lesser distinction than Republican presidents.

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386. Use of Multivariate Techniques in Naturalistic Observation. ROBERT DEITCHMAN, PATRICK MALONEY, KEVIN WALSH (University of Akron).

The value of using multivariate techniques in categorization of behaviors derived from naturalistic observations is examined. It is suggested that these techniques are superior to traditional methods of forming categories based on *a priori* conceptualizations, simply correlating the measures, or leaving the categorization of a multitude of behaviors to the reader. The present study used factor analytic techniques to identify both the number and nature of dimensions of rodent social behaviors observed in the open field. Predictions as to the relationship between these derived categories and visual behaviors were then made. It was shown that rodent social behavior is not unidimensional and is related to visual experience. Also, the utility of using multivariate statistics for both analyzing and categorizing a large number of behaviors was shown.

387. Laboratory Equipment and Human Operator Interaction: A Possible Source of Error Variance in Laboratory Data. WILLIAM W. BANKS, (Naval Medical Research Institute, Bethesda, MD 20014 USA).

Laboratory experimentation under hyperbaric conditions requires the use of expensive and complex equipment, which must be maintained and operated by laboratory personnel. The equipment should be designed to minimize the procedural variations of different operators, reduce errors, and increase the combined functional performance of both men and machines. This study used human engineering design standards as criterion and four control operators as test subjects. Full-scale equipment mockups were employed in the attempt to identify control system inadequacy that might influence experimental outcomes during the investigation of biologically sensitive variables. The results indicate that present equipment designs can be substantially improved to reduce operator control variation by programming design considerations such as operator height, information processing, and training/experience into the final hardware design. In addition, it is suggested that the manufacturers of laboratory equipment perform human engineering studies to determine the overall adequacy of their designs *before* marketing their products to the scientific community.

388. Neurotic Distress Stabilizes Cooperative Group Behavior: A Sociobiologic Perspective. MARC GALANTER, M.D. (Albert Einstein College of Medicine).

The ubiquitous human vulnerability to neurotic distress may have adaptive value in terms of natural selection. This sociobiologic hypothesis is supported by evidence that such distress is diminished as an individual becomes involved in cooperative group behavior. We previously reported (AAAS, 1976) on members of a cohesive religious sect, who experienced a marked decline in neurotic distress following conversion; this decline was correlated with the degree of respondents' cohesiveness toward the group. The current study was directed at continued effects of group affiliation and at the relationship between distress and conformity to group norms. Responses given by a representative sample of 237 members of a second sect, the Unification Church ("Moonies"), reflected a mean decline of 30% in neurotic distress scores following conversion. This decline was maintained over the course of membership ($\bar{m}$=33 mos), and scores on a group cohesion scale predicted 32% of the variance in current distress scores. An additional 6% was predicted when items associated with religious norms were added as predictors. The potential for neurotic distress may thus serve to stabilize group cohesion and normative behavior, engendering a better-adapted working group. This relationship could thereby increase inclusive fitness (Hamilton) by means of its effects on inter-population selection. This is discussed in relation to the sociobiologic import of psychological functions among hominids in the Australopithecine period.

389. Diffusion of Responsibility Reduces Physiological Response to Deception. WILLIAM M. WAID, MARY R. COOK, HARVEY D. COHEN, & MARTIN T. ORNE (Institute of Pennsylvania Hospital and University of Pennsylvania).

Despite the social nature of lying and the widespread use of polygraph testing, the social variables affecting physiological detection have not been well defined. We investigated the effect of varying numbers of collaborators upon the physiological response to deception. Subjects in 6-7 member groups submitted to a polygraph test in which each subject's electrodermal responses (EDRs) were simultaneously monitored. Few (1-2) or many (3-7) of the subjects in each group were "guilty," the remainder being "innocent." The examiner was "blind" as to guilt or innocence. A guilty person's deceptions were "detected" if they evoked larger EDRs than did control questions. Large guilty (3-7) groups yielded fewer detections per subject ($p < .05$) and smaller EDRs to deception ($p < .05$) than small guilty (1-2) groups. (There was no difference in basal skin resistance.) Varying the number of innocent subjects appeared to have no effect. Control procedures precluded modeling effects. Thus, in a group situation, if several people lie about the same material it is less arousing than if a person lies alone or with only one collaborator. The data represent a physiological parallel of findings that responsibility diffusion disinhibits antinormative behavior.

390. Group Problem Solving Process: A Pilot Study Replicating the Classic Bales Experiments. STARR ROXANNE HILTZ (Upsala College and New Jersey Institute of Technology), GAIL AGLE (Dominican College), KENNETH JOHNSON (Upsala College).

The independent variable in this pilot study was mode of communication (Computerized Conferencing vs. Face to Face discussion). Dependent variables measured various aspects of the process and outcome of the discussions conducted by groups of five students on updated versions of the Bales human relations problems, including Interaction Profiles, inequality of participation, and whether or not the group reached a consensus by the end of the 40 minute discussion period.

Computerized Conferencing is a new form of communication in which the participants type their comments into a computer terminal, and receive their instructions and the comments of others printed on their terminal. This is a report on the results of a pilot study which was aimed mainly at exploring and solving the methodological problems presented by the need to adapt the procedures for conducting and coding face-to-face discussions to studies of this new medium. While not enough trials were conducted to reach statistically significant conclusions, some interesting differences were observed.

391. A System for the Prediction of Teamwork Compatibility in Ad Hoc Research and Development Task Groups. Sanford B. Weinberg, Ph.D. (University of Connecticut), Larry J. Smotroff (University of Connecticut).

The authors have developed, field tested, and validated an easily administered system for the determination of optimal ad hoc working groups. The key element in the computer model employed is an assessment of teamwork compatibility based upon a multi-dimensional tool called the Leadership Octant Graph (LOG), which accurately and reliably predicts leadership development trends, group cohesion, and member cooperation. Administration of the LOG and employment of the system allows a project administrator to accurately select team members as reliably on personality measures as on skill and cost-factors. The model weighs each factor and suggests the most cost-effective and compatible teams for submitted task projects.

392. Short-term Adaptation to Overload of Interpersonal Contacts in the City. CLARK MCCAULEY (Bryn Mawr College).

MCCAULEY, C., AND NEWMAN, J. Eye contact with strangers in city, suburb, and small town. Environment and Behavior, in press.

Experimenters attempted to make eye contact with commuters as commuters approached an express train linking city and suburb and, 20 minutes later, as commuters left the same train. During both morning rush from suburb to city and evening rush from city to suburb, commuters were less willing to meet an experimenter's eye at the city train station than at the suburban station. These results are consistent with experimental laboratory evidence that social withdrawal occurs within minutes after threat of overload of strangers, thus indicating that reduced eye contact with strangers in the city (reported by McCauley and Newman, in press) is a short-term adaptation to interpersonal overload in the city. Most generally these results indicate a convergence of laboratory and field ata toward the conclusion that crowding effects on behavior are best understood as adaptation to interpersonal overload.

393. Brief and Extended Periods of Isolation on the Expression of Social Interaction. IRWIN N. LOURIE (Research Department, Norristown State Hospital).

Exploratory and social interaction measures were compared in animals isolated for 8 hours and for approximately 2 months. Male Sprague-Dawley derived rats were assigned to one of three pretest groups (N=10): isolation at weaning (21 days), grouped (5 to a cage), and grouped with 8 hours of isolation prior to testing. At about 85 days of age animals were tested in an open field paradigm consisting of 36 min of exposure to an observation cage 54x52x34 cm followed by pairing for an additional period of 36 min. Observations continued daily for a period of 8 days and consisted of time sampling segments of videotaped behavior analyzed for intensity and duration of exploratory and interactive components. Data is reported for days 6-8 when intertrial variability has stabilized. Short and long periods of isolation increase global measures of both social interaction and exploratory activity by about 2 fold. However, measures of intensity are considerably higher for the long term isolates and measures of within trials habituation rates for all behaviors are considerably lower. The deficit caused by long term isolation suggests a lack of development of inhibitory processes modulating ongoing behavior. The marked increase in social interaction caused by short periods of isolation appears to reflect a homeostatic mechanism related to an intense social drive in this species. The results are discussed in terms of the dual process theory of habituation and the ontogeny of play behavior.

394. Does a Policeman's Dogmatism Affect the Number of Assaults He Receives? Robert M. Hashway, Ronald L. Nuttall, Michael Galati (Laboratory for Statistical and Policy Research at Boston College)*

Rokeach's Dogmatism (1960) Scale has been linked to police operations. According to Kirscht & Dillehay (1967) and Vidulich & Kaiman (1961) the dogmatic personality relies greatly upon authority and categorically rejects opinions not concondant with his or her own established values. This paper reports on a test of whether an officer's own Dogmatism will affect his ability to communicate with others so as to affect the number of assaults on the officer. Data came from over 4,000 officers from 15 cities, each with a population in excess of 100,000 and chosen so that they represented each of the five geographic areas.

Four categories of assaults were used: (1) handguns; (2) shotguns and rifles; (3) hands and fists; and (4) other dangerous weapons. It was found that, contrary to Cecil and Lanberth's (1974) pilot study, dogmatism was not significantly related to assault history. These results cast doubt on the usefulness of using the Dogmatism Scale in selecting police officers.

*This paper is based on work done under a Law Enforcement Assistance Administration contract to Aerospace Corporation with a subcontract to the Lab. for Statistical & Policy Res.

395. Wrongdoing and Guilt: A Theory of Perceptual Reorganization. PERCY BLACK (Pace Univ.)

If we define wrongdoing as a voluntary act against one's moral commitments, we find that current theories of wrongdoing do not fit the wrongdoer's experience, primarily because they fail to set the act within a self that decides and chooses. I propose, therefore, that an otherwise upright person violates his conscience when certain cognitions and moods temporarily facilitate a shift from his accustomed internal gestalt. If the shift falls within the individual's personal level of tolerance to distortion of his conscience (i.e., his self-image) he will experience no guilt feelings, though aware he did wrong. Under certain conditions, however, he may decide to do the act though the internal shift exceeds his tolerance level. The result is guilt with unpleasant affect. These findings have theoretical implications for the psychology of human action in general and for moral action and guilt in particular.

396. A Modified Stimulus - Response Model. ROBERT J. HEASTON

A modified stimulus - response model is proposed as a means to mechanistically explain the psychological causes of stress. The model is defined as follows:

$$\text{RESPONSE} = \frac{\text{CAPABILITY X TIME}}{\text{PRESSURE}}$$

Arbitrary scales from one to ten for each of the right hand variables were developed so that quantitative values are obtained for human responses under various pressure environments. The time variable is a logarithmic function of the time in seconds. It is possible to derive the Weber-Fechner law from the resulting model. Numerical examples are presented for a broad range of individual, group, and societal applications. Results correlate well with literature explanations of the psychological antecedents to physiological stress.

397. Dedication to a Vegetable King: Alexander Romanovich Luria. LUCILLE SHNAYERSON-RICH, Researcher.

The paper represents a tribute, eulogy, and historical analysis of the published writings of one of the twentieth century's most prolific and productive enurophysiological psychologists. A thorough discussion of Luria's work, twenty-two published writings in the study and teaching of the neuroanatomy and diagnosis of aphasia, is part of the paper. Special emphasis will be placed on the historical development in Mr. Luria's work specifically in regards to his research theniques. His most recent contribution: COGNITIVE DEVELOPMENT: ITS CULTURAL AND SOCIAL FOUNDATION (1976) will be reviewed. A cross-cultural comparison between the study of language and thought disorder in the United States and in the Soviet Union during the past twenty years will conlude the dedication.

398. Perceived Causes of Therapeutic Outcome. HOWARD SHAFFER (City of Boston Drug Treatment Program; Project Turnabout, Inc.; Boston University), BLASE GAMBINO (Project Turnabout, Inc.).

The present study examined a) the attributed causes of therapeutic outcome, i.e., ability, effort, luck, difficulty, and b) the relationship between therapeutic outcome and selected therapist attributes presumed to be associated with success in therapy. Subjects serving in this experiment were 54 outpatients who were participating in psychotherapy at a community mental health facility. Subjects read a narrative which described a nineteen year old girl who was referred for treatment. Each narrative also included 1) a description of either a) advice, b) behavior-rehearsal, or c) client-centered therapy, and 2) a description of the outcome of therapy as either a) successful, b) no change, or c) failure. Thus, the study utilized a completely randomized 3 x 3 factorial design. The results were discussed within three general areas: therapist qualities, therapeutic style, and perceived causes of outcome. Attributions of therapist qualities were interpreted within an attributional model as the perception by patients of personal dispositions of the therapist which are causally related to therapeutic outcome. With one exception, attributions of therapist qualities as a function of therapist style were unrelated to outcome. Finally, the perceived causes of therapeutic outcome were interpreted to be related to patients' expectations of successfully coping with future situations.

399. Survival Curves From a Forty-Year Follow-Up Study of Schizophrenia and Manic-Depression. MING T. TSUANG, MD, PhD (The University of Iowa College of Medicine), ROBERT F. WOOLSON, PhD (The University of Iowa College of Medicine).

The Iowa 500 Research Project is a longterm follow-up and family study of approximately 500 psychiatric patients who were first admitted to The University of Iowa Psychiatric Hospital between 1934 and 1944. The patients were selected for the study if they met specified criteria for schizophrenia, mania or depression. A stratified random sample of 160 non-psychiatric surgical patients was included in the study to achieve blindness and to provide a baseline for comparison.

In this presentation, age-adjusted survival curves are presented for each psychiatric subgroup for each sex individually. The survival curves are estimated using life-table methodology and are contrasted to the survival curves for the State of Iowa. Plots comparing the observed survival curves in the psychiatric study groups to the curves for the State of Iowa provide a graphic display of the difference between observed and expected survival. This analysis is particularly useful for examining the difference between the two curves at any point in the follow-up period. On the whole it is found that psychiatric patients, with the exception of male manics, have significantly shorter length of survival in comparison to the general population. Implications of the survival differences are discussed.

400. An Evaluation of Psychotherapy Based Upon A Model of the Human Brain. WILLIAM B. GEVARTER (NASA Headquarters).

Recent advances in the neurosciences have now made it feasible to begin to discuss virtually all psychotherapeutic approaches in terms of their effects on associated brain functioning. This paper thus first develops an appropriate neuro-physiological model of the brain and its functioning, based on an elaboration of Dr. Paul D. MacLean's "triune brain." A tentative associated neuro-physiological "wiring diagram" of this model is presented to facilitate the discussion. Approaches to changing behavior and emotional response in terms of this model are then enumerated. Existing psychotherapies are then grouped in terms of their effects on the brain and their mechanisms discussed. Though still tentative, by this approach, the efficacy, permanency and applicablility of these psychotherapies are made apparent in terms of this model.

401. Spatial Abilities of Psychotic and Normal People. LINDA FAGAN DUBIN (Yale University).

It is agreed that in the predominantly right-handed population the left cerebral hemisphere is superior in processing verbal information and the right hemisphere, spatial information. In left-handed people verbal abilities may be shared by the right hemisphere, and spatial abilities may be compromised, possibly because of competition. Might disturbances in mental function, i.e., psychosis, be associated with alterations in the distribution and performance of verbal and spatial abilities also? Thirty-four subjects (17 inpatients at the Connecticut Mental Health Center and control subjects matched for sex and handedness) were tested by a modified Arc-Circle Matching Test of spatial perception (Nebes, R., 1971, Cortex 7, 350). There was no significant difference between the performance of the psychotic group and that of the control group in left-hand, right-hand, and total scores in this tactile test of spatial ability. No significant differences were found in test and retest scores within each group. When the data were analyzed for differences between males and females and between right and left-handers, results were nonsignificant. Nevertheless, for all subjects, the left-hand scores were superior to right-hand scores at $p < .05$. In conclusion, there appear to be no gross differences in spatial abilities between psychotic and control subjects, or within sex and handedness subgroups, as detectable by this method.

402. Stress Response and Aid-seeking in a Low-stress Population. LINAS A. BIELIAUSKAS (Rush-Presbyterian-St Lukes Medical Center).*

Stressing life events, 24 hour urine 17-OHCS levels, and MMPI K-scale scores were measured in 80 firemen who did or did not seek professional medical or psychological aid for a retrospective period of six months and a prospective period of eight weeks. The measured values did not differ significantly between groups and were, in fact, well within normal limits for all subjects tested. Analysis suggests that implied relationships between stress and illness are questionable in low-stress, low-pathology populations. These data lend further support to the concept of a threshold effect for life change influence on subsequent illness manifestations.

* This research was supported, in part, by a grant-in-aid from Sigma Xi, the Scientific Research Society of North America.

403. Feeling Good: Positive Affect in Late Life.

PAUL A. SALISBURY (New York Univ. Medical Center)
RENEE GARFINKEL (Philadelphia Geriatric Center).

In a recent study of mass media uses and gratifications in old age, the 140 respondents (residents of two adult homes) were found to be extremely concerned with life-enhancing motives i.e. creating positive affect. This is a marked contrast to the professionals' concern for preventing further decline in an already debilitated population. The residents' orientation was toward the pursuit of positive, highly individualistic and personally meaningful values. The respondents were queried as to: what they valued as important, if and how they attempted to achieve these needs or desires, and what they enjoyed most. Interpersonal, quasi-social i.e. mass media, and individual resources were varied in their use depending on the goal to be achieved i.e. using time well, feeling happy, entertainment. The use of resources also depended upon their availability, the individual's visual acuity and emotional state, and his/her sources of pleasure. Overall, individual resources were the most utilized 'tool' when trying to create positive affect, with social and quasi-social (media) resources a definite second.

404. Psychophysical Functions in Perception and Memory

DRAKE BRADLEY, ROBERT MOYER, & DAVID SEELY (Bates College)

The psychophysical relationship between apparent size and physical size was investigated in perception and memory. Each subject provided magnitude estimates of the 48 continental United States as they were named in a random order. In the perception condition ($N = 13$) a black outline drawing of the state, drawn to scale, was rear projected on a screen 50.5 cm from the subject. In the memory condition ($N = 13$) the subject projected a vivid memory image of the state onto the same screen. Upon completing the size judgments, the subject provided familiarity ratings of each state using a 12 point scale. A log-linear plot of the geometric mean magnitude estimates against the relative physical areas of the states indicated that power functions gave excellent fits to the perceptual and memorial data; $r = .991$ and .967 respectively. However, the exponent of the power function in memory was reliably smaller than in perception (.463 vs .643, $p < .001$), suggesting that memory for size is more compressive than perception relative to the original physical metric. Furthermore, a "familiarity effect" was obtained in memory but not in perception: the partial correlation between apparent size and familiarity, holding physical size constant, was $r = .398$ ($p < .01$) in memory and $r = .093$ (N.S.) in perception. Finally, multiple regression of apparent size against physical size and familiarity revealed that the regression coefficients for the physical size predictor still differed significantly in memory and perception (.490 vs .649, $p < .001$), even though the effect of familiarity is factored out statistically.

405. Familial Resemblances in Hand Preference.

MARK G. MCGEE (Texas A&M University).

Behavioral correlates of cerebral lateralization have been the focus of much research over the past decade. Recent work in hemispheric specialization suggests that the right cerebral hemisphere is specialized for spatial processing and that males have greater hemisphere specialization than females. This hypothesis has served as a tentative explanation of the sex difference on spatial tasks and predicts spatial deficiency in other presumably less well lateralized populations (e.g., left handers). Empirical data have not consistently supported this expectation, although discrepant frequencies of left handedness as a function of sex and generation, varying degree of lateralization among the first degree relatives of sinistrals, and small sample sizes preclude definitive conclusions. The present study examined familial resemblances in hand preference among the parents, grandparents, aunts and uncles, and siblings of 400 index subjects. Sex and generation differences are shown, and a continuum of cerebral bilateralization based on human handedness is proposed.

406. Lateralization Patterns in Selected Pedigrees Exhibiting Familial Dyslexia[1].

BONNIE FRANK CARTER[2] (The University of Connecticut), BENSON E. GINSBURG (The University of Connecticut).

Configurations of patterns of lateralization for handedness, visual processing of linguistic and non-linguistic symbols, and auditory processing of linguistic and musical elements were assessed in 13 families with recurring dyslexia in which no neurological, IQ or psychiatric problems were encountered. Aberrant configurations of laterality were found which were consistent within groups of genealogies, but different between them. Were we to characterize these patterns without regard to genealogy, no meaningful analysis would be possible. Anomalies of lateralization occurred in some normally achieving relatives of dyslexics, suggesting the existence of naturally-occurring coping mechanisms. This investigation is being extended to an additional learning disabled population and comparable laterality data are being collected on a control sample. Identification of patterns of variation is essential if such research is to find applicability in the classroom. The relevance of the genetic framework to other areas in the study of behavioral aberrations will be discussed.

[1] The authors gratefully acknowledge the cooperation and collaboration of The Carroll School, Lincoln, Mass.

[2] Present address: The Pathway School, Audubon, Pa.

[3] Supported by PHS grant HD 08195-02, a grant from The Connecticut Research Foundation, and The National Foundation (grant #6-155).

407. Clarification of Changes in Measures of Lateralized Background EEG Associated with Performance of "Verbal" and "Spatial" Tasks.

A.S. GEVINS (Langley Porter Institute), C.D. YINGLING, G.M. ZEITLIN.

EEG's (F3,C3,P3,O1,F4,C4,P4,O2) were recorded from 23 right-handed adult subjects during performance of 3 replications of each of "verbal", "logical", and "spatial" tasks, including Koh's block design, writing-from-memory, reading, mental arithmetic, form rotation, and control tasks. Data were edited for artifact and spectral analyzed. Summary features were computed including spectral intensity in the theta, alpha, beta_1, and beta_2 bands, ratios of spectral intensity in the same bands from inter- and intra-hemispheric locations, and characteristic frequency of the spectrum. Data were normalized within subjects between pairs of tasks, and an anatomically-constrained adaptive two-stage pattern classifier was trained to distinguish pairs of tasks. Classification performance on independent replication data was as follows: Koh's blocks vs. writing, 86% correct ($*p<10^{-3}$); Koh's blocks vs. control task (manipulation of blank blocks), 76% ($*p<.01$); writing vs. control task (scribbling), 65% ($*p=.5$). The major effect discriminating writing from Koh's block design was an over-the-head increase of theta band spectral intensity. When this effect was removed, findings consistent with previous reports of lateralization emerged, but with a much lower discriminating power (73% correct). While other-than-motoric ("cognitive") components of Koh's blocks were measurable with the above methodology, the same was not true for writing-from-memory.

408-418 Psychology (Physiological) Wed., 15 Feb., 3 p.m./ SA Cabinet

408. A Profile Instrument for the Quantification and Assessment of Alcohol Consumption: The Khavari Alcohol Test (KAT). KHALIL A. KHAVARI and PHILIP D. FARBER (The University of Wisconsin-Milwaukee).*

Data on quantity, frequency and variability of beer, wine and spirits consumption were collected from over 3,300 male and female adults. The respondents were college students, members of labor unions and reservists of the armed forces. Four standardized T-score scales based on consumption variables were constructed for each beverage. In addition, five summary scales were developed for assessment of consumption volume of each beverage, the cumulative frequency of ingestion, and the total annual absolute alcohol intake. These 17 standardized scales allow for visual and statistical inspection of an individual's or group's drinking characteristics. This new quantitative instrument seems to provide significant advantages over the past procedures involved in assessment of alcohol ingestion parameters.

*Supported by funds from the Graduate School and the College of Letters and Sciences of the University of Wisconsin-Milwaukee to Khalil A. Khavari.

409. Use of Path Analysis to Investigage the Causes of Drug Use. FRAZIER M. DOUGLASS, IV, KHALIL A. KHAVARI and JODIE NOWOTNY (The University of Wisconsin-Milwaukee).*

Demographic, psychological (Eysenck Personality Inventory, Zuckerman Sensation Seeking Scale, Crowne-Marlowe Social Desirability Scale and Taylor's Manifest Anxiety Scale) and drug use data were obtained from 310 blue collar industrial workers. A causal model, developed from a priori hypotheses and results from scalogram analysis was tested by using a split sample replication procedure. In each subsample, path coefficients (beta weights) were calculated from all demographic, psychological and lower level drug use variables. Results indicated that selected demographic and psychological variables play a very small role as causes of drug use. Instead, early levels of drug use, particularly marijuana use, were the only variables producing stable significant paths to amphetamines, barbiturates, LSD, psychedelics, cocaine and opiates. These results suggest that early drug experience may exert a significant effect upon subsequent drug use. Since these variables did not account for all of the drug use variance, further research needs to identify critical components of initial drug experience and additional demographic-psychological variables which are responsible for continued drug escalation.

*Supported by NIDA Research Grant DA01080 and funds from the Graduate School and the College of Letters and Science of the University of Wisconsin-Milwaukee.

410. Heart Rate and Cognitive Performance. JOHN T. CACIOPPO (The University of Notre Dame), RICHARD E. PETTY (The University of Missouri).

411. Immunological Intervention in the Study of CNS Functions. S. E. KARPIAK (New York State Psychiatric Inst.)

It is now well established as the result of investigations in several laboratories over the past 16 years that injections into the brain (lateral ventricle or cortex) of antiserum to some brain components induce electrical abnormalities and modify behavioral responses in several species. The most commonly used antisera have been prepared against complex mixtures of brain antigens, and one of the most effective has been antiserum to synaptic membranes. Such antisera cause sustained, recurrent epileptiform spiking patterns and interfere with various learning tasks such as maze behavior, passive avoidance, and conditioned and spontaneous alternation. Prenatal administration causes the offspring, when mature, to have subtle behavioral deficits (e.g. acquisition rates, memory). To explore mechanisms and ensure reproducibility, a molecularly defined immunological system is necessary. Antisera to gangliosides appear to be an excellent model. Such antisera are readily prepared, and we have established their chemical specificity and shown that they induce recurrent seizure activity and inhibit passive avoidance behavior. Also gangliosides are known to be present in relatively high concentration in synaptic membranes. Our most recent progress with this system has enlarged the potential of the immunological model.
Supported in part by grant NS-13762.

412. Body Fat, Spontaneous Physical Activity, and the Regulation of Body Heat. JOHN B GORMLY (Rutgers University), ANNE V GORMLY (Trenton State College).

Three groups of women were studied for their rates of spontaneous activity: women from the lower-quartile of a distribution of per cent body fat (lean women), women from the upper-quartile of the distribution (fat women), and women athletes in training. Each person wore a pedometer for three successive days. Eight weeks later, when the women athletes were no longer in training, the three groups again wore the pedometers for three successive days. Initially, the fat women accumulated one-half the number of body movements recorded from the lean women, while athletes in training recorded one-third more movements than lean women. The athletes did not wear the pedometers during training. At the second testing, the difference between lean women and fat women was maintained, while athletes not in training had slightly fewer movements than lean women. These results are interpreted within the framework that amount of movement is influenced substantially by ease of movement and that the regulation of body heat substantially influences rate of movement and amount of body fat.

413. Systemic Administration of Endorphins Selectively Alters Open Field Behavior of Rats. JANE L. VEITH, CURT A. SANDMAN, J. MICHAEL WALKER, (The Ohio State University), DAVID H. COY, ANDREW V. SCHALLY, & ABBA J. KASTIN (Tulane University School of Medicine and V.A. Hospital).

The effects of a single injection of 100 μg of α, β, and γ-endorphin or their [D-Ala^2] analog on the behavior displayed by male rats in the open field was examined. On Days 1 and 3, all animals received saline. On Day 2, animals were injected i.p. with one of the six endorphins or the diluent alone. Fifteen minutes after administration, the behavior of each rat was examined in the open field for 10 minutes. It was found that β-endorphin significantly increased grooming behavior whereas [D-Ala^2]-α-endorphin appeared to enhance sexual arousal. Both γ-endorphin and [D-Ala^2]-γ-endorphin affected separate behavioral measures of arousal. These data suggest that systemic injection of fragments of β-LPH are capable of modulating behaviors unrelated to analgesia. Furthermore, the selective effects of these different peptides raise the possibility that each may be coded to act upon receptor sites in a differential manner resulting in separate and distinct patterns of behavioral alterations.

414. Effects of CSs for Food and Water upon Rats Receiving Different Magnitudes of Food Reinforcement. RICHARD M. WIELKIEWICZ (University of Hawaii).

For each of 3 groups of albino rats a CS+ was paired with a reinforcer (either 1 food pellet, 8 pellets, or water) and a CS- was presented alone. Then, half the subjects experienced an 8-pellet reward and half a 1-pellet reward for a leverpress after onset of a light. On test trials compounds of the CS+ or CS- plus the light were presented. Latencies to the CS+ versus the CS- indicated that the 1-pellet baseline was most disrupted by the 8-pellet CS+ followed by the water and 1-pellet CS+'s, respectively. This finding strongly favors an associative view of the mediators of transfer effects over a motivational view. However, the 1-pellet CS+ on the 8-pellet baseline and the water CS+'s on both baselines caused less disruption than predicted by the associative view. These effects could be more easily reconciled with an associative interpretation than a motivational interpretation. Generally, the associative assumption that responding is at least partially controlled by a mediator associated with the reinforcer was confirmed. Unexpectedly, the pairing procedure also affected baseline levels of responding. This effect could be explained by a noncontextual theory of contrast (McHose & Moore, 1976).

415. Modulation of Consummatory Responding by Limbic System Influences. SALVATORE CAPOBIANCO (University of Scranton), and LEONARD HAMILTON (Rutgers University).

416. Prenatal Zinc Deficiency and Behavioral Development. A. T. REUTER (University of Montana), D. A. STROBEL (University of Montana), H. H. SANDSTEAD (USDA Human Nutrition Lab, N.D.).

Pregnant Rhesus monkeys (Macaca mulatta) deprived of dietary zinc from day 110 to 150 gestation developed dermatitis, alopecia, anorexia, and depressed concentration of plasma zinc. Infant progeny of the zinc deficient dams associated with their mothers more, were less active, played less, and explored less than control infants. In a series of learning experiments beginning at 500 days of age, group performances were comparable in reversal discrimination learning and in discriminations involving increased separation of cues from response loci, but unlike the control group, the zinc deficient progeny were unable to demonstrate interproblem transfer (learning set) on 100 object quality discrimination problems. Later performance on 100 additional problems was significantly improved, but still inferior to control subjects. Exposure to Sidman avoidance contingencies resulted in an equivocal impairment in the initial acquisition of the avoidance response in the nutrient deficient animals. These results suggest that ontogenic delays in behavioral maturation may result from maternal deficiencies of zinc in nonhuman primate progeny.

417. Differences Between High and Low Male Disinhibitors as a Function of Phenotype, Personality, Plasma Testosterone, 17-B Estradiol, and Estriol. REID J. DAITZMAN (Fairfield University)

The Sensation Seeking Scale was developed by Zuckerman in an attempt to provide a quantified measure of the construct "Optimal Level of Arousal". Forty college males were preselected on the basis of SSS Disinhibition scale scores and assigned to a High(n=20;Dis=11-14) or Low(n=20;Dis=0-3) group. High male Disinhibitors were statistically higher on plasma testosterone, 17-B estradiol, estriol, ten of eighteen California Psychological Inventory scales, six of ten MMPI scales, frequency and variety of heterosexual experince. Predictable phenotypic differences based upon photo ratings suggested a "prototypic" physiognomy and hairstyle and clothing between the two groups. Progesterone was not different in the two groups. Data support earlier neurophysiological and biochemical differences between high and low male sensation seekers, with the subscale Disinhibition showing a consistent relationship to biological variables. The present investigation lends further support to a biological basis of the trait "sensation-seeking" and suggests a central excitory-inhibitory mechanism mediated by sex steroids, biogenic amines, and monoamine oxidase levels.

418. Mental Phenomena Evoked by Electrical Stimulation of the Human Hippocampal Formation and Amygdala. E. HALGREN, R.D. WALTER, D.G. CHERLOW, P.H. CRANDALL. (Dept. Surgery/ Neurol., UCLA.

Of 3495 stimulations of 36 psychomotor epileptics, 267 were accompanied by hallucinations of complete scenes, déjà vu, anxiety, visceral sensations, amnesia, or unformed sensory experiences. Olfactory and frankly aggressive responses were not observed. In general, a widespread electrographic response was necessary but not sufficient for an experiential response to occur. That is, 89% of evoked mental phenomena were accompanied by an evoked-potential (EP) and/ or afterdischarge (AD), but only 10% of those stimuli that evoked an EP and/or AD also evoked a mental phenomenon. In contrast, only 2% of stimuli that evoked neither an EP nor AD evoked a mental phenomenon. Contralateral EPs were rare. Anterior electrode sites, and sites contralateral to the focus, had a higher frequency of both electrographic and mental responses. However, the category of mental phenomenon was not related to the anatomical site, but rather to patient-specific variables. Patients reporting fear scored higher on the "Psychaesthenia" subscale of the MMPI, and patients experiencing hallucinations scored higher on the "Schizophrenic" subscale, than did the other patients. Thus, in contrast to the primary visual or somatosensory areas, the mental phenomena evoked by medial temporal lobe stimulation are idiosyncratic and variable, and are related to the personality of the patient stimulated.

419-427 SOCIOBIOLOGY THU., 16 FEB., 3 P.M./ SA COUNCIL

419. Selection Principles in Social Systems. J. Dennis Willigan (The University of Utah).

Recent conceptual advances in n-dimensional information theory are utilized to create a framework for the analysis of the critical parameters guiding processes of structural differentiation and destructuralization in social systems. Theoretical issues associated with the loss of social control and social system collapse are emphasized. The function of information in social networks, system unexpectedness and coordination, and information rejection and blockage are synthesized to produce a general theory of social system hierarchization. The causal consequences of constraints upon information flow are discussed in terms of an heuristic system dynamics model involving Federal funding policies, scientific innovations, and the growth of particular types of research literature. Other topics treated include how information linkages can prove critical to understanding the dissolution of social groups, why information acquisition is essential for the maintenance of ideological dominance, and how variations in the informational content of 'demand environments' can affect social systems.

420. A Behavioral Model for Community Cancer Control. G. MARIE WILT (Michigan Cancer Foundation) and EDWARD SHAW (Michigan Cancer Foundation).

Community control of chronic disease phenomena has been based upon models of the natural history of the disease, with patient care determined by the stage of the disease and physical prognosis for the patient. Through the nation's first community-based cancer control program, a new model of chronic disease control has emerged--one which posits human behavior change as the focal point for defining roles for patients (or potential patients) and their families, of health care providers, and other helping cadres, and for creating new systems relationships among these participants in health care delivery.

Studies conducted by our group show that Detroit residents (a) fear cancer, (b) are very concerned about the potential for becoming victims of cancer, (c) are sophisticated about cancer risk factors, yet (d) rarely engage in self-surveillance behaviors and rarely seek cancer detection examinations, depending instead on the physician to "protect" them from the disease. Other data indicate, however, that few physicians provide substantive patient education and instruction in cancer self-surveillance, and that only rarely are physicians autonomously disposed to perform cancer detection examinations routinely. Analysis of disease trends locally reveal that significant proportions of patients have advanced disease at first diagnosis.

The result is that persons are dying and suffering needlessly from cancer. Only by addressing the behavioral and sociological factors which affect the disease management process can we hope to achieve maximal gains in the reduction of cancer morbidity, in a context wherein the biological control of the disease is not yet possible. Operationally, therefore, we have defined cancer control as change in human behavior, and the model of cancer control we have developed is grounded in the effective application of sociological and psychological understanding, as well as medical understanding, for the management of a chronic disease on a community basis.

421. The Hawthorne Experiments: First Statistical Interpretation. RICHARD HERBERT FRANKE (University of Wisconsin-Milwaukee), JAMES D. KAUL (University of Wisconsin-Milwaukee).

A guide is provided to the proceedings of the Hawthorne experiments, and experimental data are now made readily available. Data from the main experiment (that in the first relay assembly test room at Western Electric) are interpreted statistically for the first time. Precise analysis of this "quasi experiment" is accomplished by time-series multiple regression using nearly five years of data. This analysis demonstrates that experimental variables account for some 90% of the variance in quantity and quality of output, both for the group and for individual workers. Imposition of managerial discipline, economic adversity, and quality of raw materials provide most explanation, obviating the need to draw upon less clearly definable human relations mechanisms. For decades the Hawthorne studies have provided a rationale for humane approaches in the organization of work by suggesting that considerate or participative treatment of workers led to better economic performance. The present empirical analysis suggests, however, that humanitarian procedures must provide their own justification.

422. Help for the Unknowing Needy. ROULETTE WM. SMITH (Far West Lab., San Francisco; School of Medicine, Univ. of California, San Francisco).

This report describes an ongoing research project aimed at resolving issues, approaches and implications related to providing help to/for persons who are unaware, cannot be aware, or refuse to be aware of their needs for help. The present discussion focusses on providing medical help, with related problems in education, philosophy (and ethics), social science, and information science being discussed. Recommendations based on system and logistic science models are cited, along with examples of alternative approaches for/to professional help and health care. Theoretical issues (related to complex human information processing, clinical decision-making and general approaches to helping) are also reviewed.

423. The Occurrence of Handicapped, Women, and Other Minorities on Television. HELEN E. KELLER (West Virginia Univ.) and E. C. KELLER, JR. (West Virginia Univ.).

This project was designed to examine the occurrence of women, handicapped, and minority individuals on television and to compare the observed occurrence of individuals in these various categories to their expected occurrence. ABC, CBS, and NBC were monitored, at random, for one minute intervals for a total of 25 minutes on each network. The five minority categories scored were: white (including oriental), black, chicano, american indian, other, and whether they were handicapped or not. Sex was also scored. The types of program viz., police/detective, commercial, soap, etc., were also scored. Certain types of programs were not scored i.e., sporting events, concerts, the news, musicals, movies, etc.

The results indicated that the minorities were all under-represented on TV as compared to their occurrence in the general population. In commercials, for example, overall there were 50% non-handicapped white males, 44% non-handicapped white females, 4% non-handicapped black males, 2% non-handicapped black females, 0.2% blind white females, and 0.2% blind white males. As an example, the table below shows the distribution of percentages of individuals among the three networks for commercials. The overall data generally indicate an extremely large difference between the occurrence of the minorities in the general population and the occurrence of those minorities on television.

Classification		NETWORK							
		ABC(182)		CBS(219)		NBC(123)		Overall(520)	
		H(1)	NH(2)	H	NH	H	NH	H	NH
White	female	0	44	0.5	46	0	41	0.2	44
	male	0	52	0.5	43	0	58	0.2	50
Black	female	0	1	0	3	0	0	0	2
	male	0	3	0	7	0	1	0	4
Total	female	0	45	0.5	49	0	41	0.2	46
	male	0	55	0.5	50	0	59	0.2	54

(1) H=handicapped; (2) NH=non-handicapped; numbers in ( ) represent the numbers of individuals counted.

424. Forecasting Demands for Public Services Resulting from Large-Scale Project Location. ELLEN A. RAMLET (Battelle-Columbus Laboratories), KATHY SMOLER SMITH (Battelle-Columbus Laboratories).

In recent years, attention has increasingly been paid to the social and economic consequences of the location of large-scale projects (e.g., energy facilities) on communities involved. In particular, a subset of those consequences has included increased demands placed on subject communities with regard to public services. For example, increased population resulting from employment at a new nuclear power facility would require services such as police protection, sewage treatment, and health care, to name a few. In most cases of recorded studies, measurement of the magnitudes of such impacts on existing services are expressed only qualitatively. The purpose of this paper is to describe a quantitative approach to estimating the effects of increased demands for public services. The methodology includes a small model that is capable of forecasting public service utilizing regional or local indicators of demand. The forecasts are made for each year of the expected impact, from construction to operation. Development of project-related demand indicators and their comparison with available supply of services provides an analysis that is useful to communities, business people, and government officials for planning purposes.

425. An Analysis of the Sociological Factors Affecting the Productivity of Socioeconomic Systems. REGINALD L. HENDRICKS and HAROLD W. MARTIN (both of Rensselaer Polytechnic Institute)

The fundamental interrelations and differences between functional mangement and nominative Management within the animate subsystem of a socioeconomic system are analysed, defined and illustrated. The general nature of purely productive work is defined. Therefrom related, precise productive work definitions are developed for specific systems; as in manufacturing, selling or service systems. The determining influence on the degree of achievement of the primary objective of a functioning socioeconomic system exerted by purely functional management people, because they alone directly control the proportions of purely productive vs. nonproductive work achieved per unit of time, is explained. Various views, from Adam Smith to present day writers, as to the true primary objective of socioeconomic systems are reviewed, quoted and discussed with the intent of deriving a logically realistic conclusion. The results of US, Nigerian and UK research into the interrelations between nominative Management's attitudes towards the functional management workforce, the latter's acceptance of innovation, their satisfaction with their work environment, and socioeconomic systems productivity are described and charted. Data are presented indicating that the degree of socioeconomic systems achievement of their primary objective is critically dependent on their nominative Management's attitudes toward their subordinate functional management workforce.

426. The Power of Social Indicators Based on the U.S. Census to Predict Mental Health Distributions within an SMSA CHARLES E. HOLZER III, PH.D., GEORGE J. WARHEIT, PH.D. AND LYNN ROBBINS, B.S. (University of Florida)

Recent efforts have attempted to use U.S. Census data to assess differential mental health (MH) needs within urban areas. This study provides an evaluation of that technique through comparison of census-based social indicators (SI) with results of an epidemiological field survey. Correlations as high as r=.84 were found between MH mean scores and census-based SI scores, thus supporting the use of SI in MH planning. Nonetheless, the results vary, being stronger for tracts than for EDs; correlations as low as r=.19 were found for some MH measures. To determine the power of the SI method, the analysis was shifted to prediction of individual rather than aggregate (tract or ED level) health scores. Multiple regression analysis showed approximately 5% of the individual score variance could be explained by (tract or ED) SI scores. However, no more than 10% of individual MH score variance could be explained by tract or ED means of these same MH measures. The primary limitation on this prediction of MH need is the heterogeneity of MH level found within each tract or ED. The degree to which the SI approached this limit ranged from 75% for depression scores to less than 2% for alcoholism scores. Finally, all SI predictions were lower than those obtained from individual sociodemographic characteristics; this points to the need to use demographic as well as geographic stratification in estimation of MH needs.

427. The Acquisition of Supplementary Socioeconomic Information by Non-Federal Sources. KATHY SMOLER SMITH (Battelle-Columbus Laboratories).

In performance of their tasks, many planners, researchers, and other professionals rely on socioeconomic data. The literature is replete with Federally generated statistics, studies, and other government reports that supply such data. Although the data user may require some of the indicators reflected in national sources to derive a sketch of a particular geographic area, he or she may also need more specific information as each area is likely to demonstrate unique characteristics that may vary from the national pattern. This paper focuses on independent sources including chambers of commerce, associations, businesses, and, in some cases, state and local governments that have found the need to obtain specific social and/or economic data to answer specific questions or address problems that could not be fully treated using national data, and what types of specific data they have generated. Several case studies are reviewed, reflecting the problem, the data required, and the results. Knowledge of how others have gone about gathering information to supplement Federal statistics can be useful to professionals who may, at one time or another, be faced with a similar situation.

428-436 POPULATION & URBAN AFFAIRS — MON., 13 FEB., 9 A.M./ SA CABINET

428. A Worldwide Analysis of the Benefits of Fertility Reduction.

DOUGLAS L. MAXWELL (General Electric-TEMPO, 777 14th Street, NW, Washington, DC 20005)

Two unusual complications arise in an analysis of the benefits and costs of a large scale fertility reduction program, such as an accelerated reduction of fertility in the Third World. First, the number of people receiving the benefits is affected by the program. Second, the capital per laborer will rise which reduces the natural rate of interest. (It is shown to be plausible to ignore the possibility of offsetting changes in the saving rate, the rate of technical change, or of labor force participation rates.) More usual complications also occur such as the appropriate measure of benefits. A qualitative resolution of these problems is illustrated by a multi-decade quantitative simulation at the global level.

429. The Demographic Transition in France.

Katherine A. Lynch (The University of Utah), J. Dennis Willigan (The University of Utah).*

The demographic history of France in the nineteenth century has attracted considerable attention from scholars because of its deviation from the conventional model of "demographic transition" theory. In our previous research, we have identified what appear to be the major stages of French demographic history in the nineteenth century. Our work is based on data from Etienne van de Walle's The Female Population of France in the Nineteenth Century (1974), a reconstruction of the French female population, by department. In the present paper, we explore some of the causes underlying the demographic shifts we have identified, concentrating on the interrelationships among such indices as: general fertility (I_f), marital fertility (I_g), illegitimate fertility (I_h), proportion married (I_m), and the singulate mean age at marriage. Attention is paid to both aggregate trends and the patterns of regional variation.

* Order of authors is alphabetical.

430. The Effects of Breastfeeding on Population in Major World Areas.

Dana Raphel, Ph.D. (The Human Lactation Center)

Lactation has functioned as the major birth-spacing "device" for human beings (and possibly most mammals) throughout history. Many researchers interested in population control are beginning to recognize and study this other functional effect. Recent reports suggest that by inhibiting ovulation, lactation extends the inter-pregnancy intervals by as much as 70%. Thus, it is an invaluable addition to population control.

It is therefore alarming that breastfeeding, especially in the circum-urban sectors of developing countries, is being shortened or eliminated. One contributing factor is the breakdown of the supportive network around the mother. When the mother does not receive supportive care from a network of relationships, breastfeeding fails. This leads to the increased use of alternative foods frequently with disastrous effects from lack of financial resources, contaminated water and over-dilution of this extremely costly product.

The paradox is that lactation enhances infant health, increases the inter-pregnancy stage and yet often mothers find it difficult, sometimes impossible, to breastfeed due to the pressures and changes caused by new urban influences and increased food prices.

431. Maternal Phenotype and Pregnancy Outcome: Later effects of early bio-social stress.

R. S. WEINSTEIN (Cornell University)

Animal studies have shown that early and chronic exposure to nutritional stress alters some physiological and behavioral aspects of the adult organism, and that these changes may be irreversible. With a high percentage of the world's population chronically undernourished, it is important to understand the long-term consequences of this deprivation. This research examines the relationship between early exposure to bio-social stress, notably undernutrition during growth and development, maternal phenotype variability and pregnancy outcome. Information collected on three groups of Mexican women include anthropometric, biochemical, nutritional, placental and socio-economic data, as well as health and pregnancy histories and infant maturity indicators. Two of the groups are rural-urban migrants into Mexico City at various ages from poor agricultural communities, the third is urban-born. All women had extensive prenatal care and were adequately nourished. Ethnic composition and SES were comparable. The main difference between the groups is the age and duration of exposure to developmental stress. The results indicate that stress during "sensitive" periods of growth affects the maternal phenotype and ultimately pregnancy outcome. These changes appear to be irreversible and cannot be mitigated by later improvement in the bio-social environment. Further results of the study and its' implications will be discussed.

432. An Alternative Paradigm for the Design of Cities.

C. STEGER (Virginia Polytechnic Institute & State University).

One of the fundamental problems faced by the managers and designers of the built environment is the translation of the knowledge generated within disciplinary areas into parameters for the design of the built environment. Paradigms which have guided designers of the city in the past have proven incapable of effectively incorporating new knowledge and perspectives. A new paradigm for urban design decisions is offered which moves closer toward reflecting a substantive understanding of design parameter which result from limitations on energy resources and an increased awareness of the need to integrate built form with the dynamics of natural systems. Two alternative city forms are generated by employing the proposed alternative paradigm.

433. Some Problems Encountered in the Development of a Mathematical Model of Travel in Continuous Urban Space.

DONALD P. BALLOU (SUNY-Albany), JOHN S. PIPKIN (SUNY-Albany).

The paper summarizes some problems and results that have arisen in constructing a continuous mathematical model of origin-constrained urban movement. The model is motivated by the continuity properties of urban trip-origin and termination fields implied by recent work in mathematical geography. These fields can be modelled through the application of interpolation or approximation techniques to judiciously chosen data points. Formulas analogous to those arising from origin-constrained discrete gravity models allow expected flows between arbitrary regions to be estimated. This approach is more flexible and requires less data than existing origin-destination models. The problems discussed include: The development of measures of expected flow and its variance; interpolation/

approximation of urban fields; efficient numerical integration of the flow expressions; and problems of disaggregation and route-choice.

434.
Moving Toward No Growth: The American Metropolitan System in the 1970's. PHILLIP D. PHILLIPS (University of Kentucky).

The American metropolitan system, comprised of Standard Metropolitan Statistical Areas (SMSA's) designated by the Office of Management and Budget, has undergone a dramatic deceleration in growth since 1970. Deceleration of growth was most notable in the Northeast and North Central Census Divisions, but even the "Sunbelt" area of the South showed a decline in metropolitan growth rates. Declines in growth rates were also related to city size, being most severe for the largest cities. Metropolitan areas of over 2,000,000 showed an overall population decline from 1970 to 1975. The decline in metropolitan growth and its regional and size related patterns result from several major trends, among them: slower overall national population growth resulting from smaller desired family size and increasing use of contraceptives and abortion, a reversal of net migration to favor nonmetropolitan rather than metropolitan areas, more favorable perceptions of rural life, improved communications to nonmetropolitan areas, and higher energy costs in highly metropolitan states. Slower growth will present social, political, and psychological problems in acceptance of stability, dealing with a near zero sum game of metropolitan growth in which growth of some areas and regions will necessitate decline in others, and possible development of a noninnovative risk avoidance style of public and private management.

435. Public Safety Impacts on Socio-Economic Conditions in a Metropolis. ALFRED M. FUERST (New York City Department of City Planning, ELLIOTT METZ (New York City Department of City Planning).

Public safety is of paramount importance to economic and social development especially in a large city. Economic decline and lesions in the social fabric including job losses and outmigration of tax basis supporting citizens, are to a considerable extent results of deteriorating public safety situations. This paper deals with public safety problems in New York City. It analyzes public safety in New York City and elaborates on computer assisted techniques to evaluate in absolute and in relative terms public safety in different parts of the City and to pinpoint areas in need of special attention. These techniques indicate how more efficient deployment of available resources can be helpful both in dealing with immediate crises as well as in preventing deterioration of neighborhoods beyond the point of no return.

436. Social and Economic Impact - Flood Insurance on the Passaic River Basin - ELLA F. FILIPPONE (Passaic River Coalition) BETTY A. LITTLE(Passaic River Coalition)

The Passaic River in northern New Jersey has been recognized as the most flood-prone urban river in the United States. The problem has existed since the founding of the nation, and government has attempted to alleviate the problems since 1870. To date no implementable program has been adopted. Thus, the social and economic impact of the flood insurance program could provide a means of restricting development in this constantly urbanizing area. The paper evaluates the social response to the flood insurance program and the economic strategies involved in initiating additional encroachment in the flood plains as well as restricting such growth.

437-445 ARCHAEOLOGY & ANTHROPOLOGY MON., 13 FEB., 3 P.M./ SA CABINET

437. The Lothagam Mandible and Hominid Origins. ROBERT B. ECKHARDT (The Pennsylvania State University).

A right lower mandibular fragment containing M_1 was found at Lothagam Hill in northern Kenya in 1967. This specimen (KNM-LT 329) was provisionally assigned to *Australopithecus* sp., cf. *A. africanus*. A later diagnosis attributes this fossil to another gracile hominid taxon, *Homo habilis*. This paper reports the results of detailed morphological comparisons of Lothagam with samples from several extant hominoid taxa (26 chimpanzees, 49 gorillas, 30 modern Bushmen, and 30 modern East Africans). Lothagam lies within the range of metric variation of the Bushman sample in only 2 of 16 measurements, and within the range of the larger-bodied East Africans in the same 2 traits plus 4 others. In comparison, Lothagam falls inside the range of chimpanzees only in 2 traits, within the ranges of both apes in 2 more, and within the range of gorillas only in a further 6 traits. Whenever Lothagam falls outside the range of extant hominoids, it is above the maxima of both human samples as well as of chimpanzees, while only slightly below the minimum of the gorilla range. These metric comparisons establish that the Lothagam mandibular fragment is not particularly gracile. Analyses of more complex multivariate and meristic traits support the conclusion that the Lothagam specimen does not provide reliable evidence for the existence of a gracile hominid lineage in East Africa prior to 5 million years ago.

438. Was Neanderthal Black? A clue to his disappearance? ALAIN CORCOS (Michigan State University)

The sudden disappearance of the Neanderthals of Western Europe will be discussed. It is proposed that the Neanderthals were dark skinned and consequently highly subject to Vitamin D deficiency and cold injury in the Northern latitudes, especially during the ice age. The dark skinned Neanderthals were replaced by natural selection pressures by light-skinned individuals (Cro Magnon) less prone to these problems.

439. Biostratigraphy, Zoogeography, and Paleoecology of the Late Pleistocene Valsequillo Fauna from Archeological Sites in Puebla, Mexico. RUSSELL W. GRAHAM (Indiana Univ.-Purdue Univ. at Indianapolis).

The Valsequillo Gravels, a complex sequence of crossbedded gravels and sands that are interbedded with extrusive volcanics and mudflows, contains an extinct mammalian megafauna that is associated with a Pleistocene lithic assemblage. Different dating methods have provided discordant absolute dates for the Valsequillo Gravels that range from late to middle Pleistocene. Contrary to the preWisconsin absolute dates, the lithic assemblage and the evolutionary stages of the mammalian fossils indicate a late Wisconsin age for the Valsequillo Gravels. The zoogeography of the Valsequillo fauna demonstrates that mammalian species of the late Pleistocene fauna of central Mexico were derived from both northern North America and South America as well as indigenous species that live at higher elevations today. This "intermingled" fauna suggests that, in contrast to the modern climate, the late Pleistocene climate of Puebla was cooler and moister with reduced seasonal extremes and supported a greater diversity of large herbivores.

440. "Flaggy Sandstone": A Clue to Buried Archaeology in Eroding Deserts. EMMA LOU DAVIS (Great Basin Foundation), JACQUELINE NICHOLS (Catholic University of America).

Long continuities of PaleoAmerican archaeology exist in bed sediments of Western dry lakes. Stone tools and bones of extinct animals are deposited under two undesirable conditions: either deeply buried (and hidden) or exposed by erosion and therefore stratigraphically uncertain. Observations and experiments at China Lake, Stake 1, demonstrate a means of tracing "exposed archaeology" into buried stratigraphies as follows. 1) Exposed tools and bones were once members of stratigraphic sections; 2) portions of these sections remain buried, intact; 3) paleosols are the units containing the archaeology; 4) if a paleosol margin can be identified, the contained archaeology can be recovered by horizontal excavation; 5) A GEOLOGICAL FORMATION CALLED FLAGGY SANDSTONE IS A CLUE TO THE PRESENCE OF ERODING PALEOSOL MARGINS.

441. Interdisciplinary Research: Its Application to Archaeological and Historical Data from Dilbat and Terqa, The Prospect of an Analytical and Interpretive Continuum. NICHOLAS M. MAGALOUSIS (University of California at Los Angeles).

The primary objectives of this research were to 1) establish an overall orientation and framework for future analysis of this type, 2) to determine the relationship of artifacts and soils of two sites in the Near East, Tell Dilbat and Tell Terqa (on a preliminary basis, as the sampling was small), and 3) the long-term objectives will be an attempt to reconstruct social, political and economic trends (when the specialized data bank is established).

A synchronic interdisciplinary effort was required, as several universities and analytical techniques were utilized — optical emission, atomic absorption, thin section, botanical and computer analyses. A general attempt was made to formulate a continuum of research standards, from the original field excavation to the actual laboratory analysis; this standardization would establish an overall climate of reproducibility and credibility.

442. The Recognition and Use of Umbelliferae by Native Americans in the Columbia Plateau of the Northwestern United States. EUGENE HUNN (University of Washington).

The Columbia Plateau has been continuously occupied by human beings for 10,000+ years. This long and stable human occupation was eventually based on a diversified subsistence economy without cultivation dominated by two types of resources, anadromous fish and tuberous roots (Umbelliferae primarily). Today the fishing resources have been radically reduced. The root resources, however, have been less dramatically affected. Thus much can still be learned of this aspect of the native economy. Work in progress clearly demonstrates the empirical accuracy of traditional cultural knowledge of portions of the native flora and documents the selectivity of folk botanical knowledge. This is most clearly exemplified by the extraordinary cultural focus on umbelliferous plants in this region. Of approximately 50 species of native Umbelliferae within the traditional life range of Sahaptin speaking peoples (the dominant language of the Middle Columbia basin), 22 are recognized and named at the folk generic level and classed in 22 folk generic taxa (however, not in precisely one-to-one correspondence). Particularly noteworthy are several species of restricted occurrence and limited population which are nevertheless well known. Several species are readily recognized, but ignored in the nomenclature.

443. 2^P3^q Programs in Music History. FRED FISHER (North Texas State University).*

It is becoming apparent that a most effectual tool for probing man's deeper intellectual past is number. Numbers can be regarded as "artifactual" when they carry specific meanings that man himself has created. Since man's early acoustic experiences colored his attitudes toward other fields (astronomy, government, etc.), findings in musicology can be important to cultural anthropologists generally. The Sumerian number 360, for instance, has been shown to have very specific acoustical meaning and indicates how far advanced man's acoustic experimentation was by the 3rd and 4th millennia B.C. Other numbers such as the 260 of the Mayan calendar, the "unlucky 13," and so on are similarly artifactual. Better than any other person today, the mathematical musicologist can unravel the meanings of such numbers.

***Refers also to work of EDITH BORROFF (SUNY at Binghamton), FREDRIC LIEBERMAN (University of Washington), and ERNEST McCLAIN (Brooklyn College).**

444. Altruism and Evolutionary Biology. ZVI OSTRIN (Brooklyn College of the City University of New York).

Like Humpty-Dumpty's words, the word altruism is used by evolutionary biologists, ecologists, social psychologists, and philosophers to mean what they want it to mean. This results in ambiguity when discussing altruistic traits in animals or when comparing animals with humans. Three types of altruism can be distinguished in the scientific and philosophical literature. Altruism-I, or strong altruism, is classical "real" altruism coined by Comte and reflected in common usage. Strong altruism requires conscious but uncalculated consideration for others, is probably rare in humans and nonexistent in animals. Altruism-II, or weak altruism, covers benevolent human actions based on enlightened self-interest, and may also cover actions of some social animals. Altruism-III, or unconscious altruism, consists of altruistic-like actions, including almost all animal behavior called altruistic (e.g., Trivers' reciprocal altruism). Much of the present uproar in sociobiology results from less-than-rigorous use of Altruism-III behavior studies to draw conclusions about Altruism-I and Altruism-II human behavior. A model is presented for the dynamic evolutionary relationship in humans of strong altruism, weak altruism, and egotism. In this model, existence of selectively disadvantageous strong altruism can be partially explained as the consequence of a stochastic distribution of behavioral traits influenced by the idealization of Altruism-I in many human cultures.

445. The Growth/Time Curve and the Future of Man. C. GORDON WINDER, (University of Western Ontario).

Growth of entities during time follows a variably shaped bell curve reflecting extremes of skewness and kurtosis. The charge and discharge of voltage from a condenser follows approximately a symmetrical bell curve but the acceleration of a bullet rises sharply and declines more slowly. The acceptance of an idea (continental drift) rises and falls unless new "energy" enhances (plate tectonics). (At present, where is this latter idea on the growth curve?) Income for most people over their life time follows the curve! New "energy" for a growth entity may be ideas, technology, money, men, discoveries, etc.

During geological time, the maximum size of groups of organisms - maximum size of tribolites in the Devonian, reptiles in Cretaceous, etc. (Copes Law) - is followed by a successive lesser attainment of size until the point of extinction. Does man follow this trend? The height of a man actually decreases subsequent to age 50 and decrease in height is terminated by death. The trend of general height increase for man over the last century has probably ceased. The G/T curve would predict that future man will be shorter and have decreased longevity.

The human population of the earth is still increasing but the rate of population increase is now decreasing. Absolute population numbers will continue to increase until a projected zero population increase occurs about the year 2050. Contributing factors will be depleted resources, pollution, war,pestilence and disease.

446-454 ECONOMICS THU., 16 FEB., 3 P.M./ SA COLONIAL

446. Technology and Economic Growth: Review and Comment

DOUGLAS A. SAMUELSON and ROBERT R. WILSON (Federal Preparedness Agency)

In the recent controversies over limits to growth, economic entropy, and "hard" and "soft" energy technologies, the role of new technology has been a pivotal question. We review the literature on economic growth, natural resources, and the effects of technology, with emphasis on these controversies. We then present an economic framework for considering technology as an input to production and examining its interrelationships with other inputs to production. Using this framework, we examine the hypothesis of eventual diminishing social and economic returns to technology and discuss the implications of this hypothesis for social policy.

447. An Economic/Engineering Energy Demand Model of the Paper Industry.

DAVID B. REISTER (Institute for Energy Analysis), WEN S. CHERN (Oak Ridge National Laboratory), HOANG D. NGUYEN (Oak Ridge National Laboratory).

The paper mill industry has been divided into a pulp and paper sector and a process steam sector. Each sector has been further subdivided into several processes. A production function gives the inputs and outputs for each process. The inputs and outputs of each process will change in response to changes in factor prices, technology, and government policy, and will be averaged over regional differences. Each process faces a capacity constraint which can be relaxed by new investment.

448. Instant Estimation of Consistently Perturbed Input-Output Vectors.

IRVING H. SIEGEL (U.S. Department of Commerce).

A simple and speedy alternative to the classical Leontief method is available for estimating the new vector of gross industry output that is implied by a specified perturbation of final demand. This alternative requires but minimal arithmetic. In particular, it dispenses with two hallmarks of the classical approach: the matrix of constant "input-output" coefficients and the inverse matrix of constant "technological" coefficients. Furthermore, it is just as conveniently applied (the Leontief procedure is not) when the problem is to estimate border vectors other than gross output corresponding to a perturbed vector other than final demand (say, value added). Another merit, perhaps, is that it yields results not much different, for many practical purposes, from those indicated by the established method. It has its own rationale, however, and is not being proposed as merely a "first approximation" to the Leontief model.

449. The Economic Impact of a U.S. Nuclear Moratorium.

DR. DON G. SCROGGIN (Yale Law School).

The impact on the U.S. economy of a moratorium on further development of nuclear power beyond those light water nuclear reactors now operating or under construction is examined in detail. The availability of alternate sources of energy to meet projected energy demands is evaluated for several energy growth rates. The effect of a vigorous energy conservation program is examined with regard to levels of comfort and convenience, levels of employment, and rates of economic growth.* Various scenarios for the next 25 years are considered with and without energy conservation. Energy conservation is shown to be critical to continued economic growth and maintenance of living standards (as measured by per capita GNP or levels of comfort and convenience) if a nuclear moratorium is instituted.

*See, e.g., Don G. Scroggin, "Energy Conservation in the U.S.," 51 Yale Scientific 9-13 (1977) and Don G. Scroggin, "Nuclear Power and Connecticut's Energy Future," Connecticut Energy Advisory Board Chairman, Hartford, Connecticut, 1976.

450. Estimating Labor Force Availability for Large-Scale Energy Facilities.

JOHN D. MILLER (Battelle-Columbus Laboratories), GEORGE A. WATKINS (Battelle-Columbus Laboratories), CHERYL STUMP (Battelle-Columbus Laboratories)

Planners for large-scale energy facilities (e.g., nuclear power plants) are confronted by the critical issue of realistically identifying labor force availability for the construction and operation phases. Most estimates of labor force availability either underestimate and/or overestimate the potential available labor force by required occupational skills. This paper presents a methodology for estimating labor force availability by occupation on a year-by-year basis for the construction phase. The methodology is based upon previous experience with nuclear facilities, extensive contacts with building trades unions, construction site accessibility, and estimates of labor force requirements. The methodology includes a systematic approach for estimating commuting patterns of the potential labor force and selected characteristics of the immigrant labor force including size, family composition, and the number of school-aged children. These estimates provide vital information that is useful not only to project planners but to labor unions and officials of impacted communities.

451. A Procedure for Assessing and Improving Managerial Productivity.

KENNETH D. MACKENZIE (University of Kansas and Organizational Systems, Inc.).

Organizations have a task-role system which is the actual system of work flows. They also have an official-role system describing the organizational chart and an authority-role system which describes who can preempt what decision. These systems change at different rates and so there are inconsistencies between the task-role system and the other two systems. These inconsistencies create disrupted processes, overload, duplication of effort, overlapping responsibilities, unclear division of labor, power struggles, and excessive committees. A procedure called Organizational Audit is used to ascertain the task-role system. A computer simulation analysis of possible reassignments and realignments to arrive at a better system is done by a process called the Organizational Analysis. Estimating the time spent on organizational maladaptations yields a lower estimate of the costs of these inefficiencies. The Organizational Analysis yields potential savings to the efforts made by managers. The models used to integrate and process the information during the Organizational Analysis are based upon extensive laboratory studies and have been tested in a number of organizations.

452.

Development of Productivity Measurement Systems for State Social Services.

EUNICE H. BAXTER, ALEC McKAY (Petroglyph Research Associates, Olympia, Washington)

A project goal was to evaluate social service programs in terms of efficiency and effectiveness. Emphasis was placed on client-centered effectiveness measures. Development of these measures is discussed. A second project goal was to determine if productivity could be conducted from within an agency. A number of problem areas were encountered, in personnel, budgeting, use of computers, research design and field implementation, and utilization of results. Each program area is discussed in detail, including solutions that were found.

453. Development of Objective Criteria for Evaluation of Hospital Management Reports: An "In Situ" Investigation and Application. MARGARET ANNE LERRO OLNESS (Suffolk County Department of Health Services.)

Desirable features of management reporting tools and their importance to the hospital administrator are reviewed. The principal computer-based reports used in one modern hospital are examined in depth: these include two external reports - HAS and RMS - and one internal report, a Biweekly Budget Analysis. A set of eighty-nine objective criteria on hospital management reports are developed from a systematic abstraction of the literature, and are arranged in tabular form, grouped according to generally recognized functions of management. Numeric scores corresponding to ranges of performance are assigned, and the criteria are applied to an *in situ* evaluation of existing management reports - a pilot study limited to one hospital: St. John's Smithtown.

These results are found to be in essential agreement with data from an opinion survey of area administrators: RMS is superior to HAS.

A discussion of specific conclusions, together with recommendations for refinement of the evaluation procedure are presented.

454. Computer Office Systems. ROBERT T. ELLSWORTH, JR. (Data Processing Division, IBM Corporation).

Rising administrative costs and communication problems in business and government have focused attention on the potential application of computer systems to the general office, where the preponderance of written communications are textual and the main cost is labor. An office is defined as the interaction of people to complete processes involving the handling of information with the aid of office equipment. The paper summarizes the results of studies of large general offices, such as a company headquarters. Quantitative analysis of the activities of office secretaries, clerks, professionals, and managers has led to an understanding of how office personnel expend their time. From this, and other survey activity, the requirements structure for a computerized office system have been derived. The principle functional requirements are document capture and creation, filing and retrieval, distribution and receipt, format and output, personal services, and system services. This in turn has led to the development of conceptual computer system solutions and estimates of how they might affect office productivity in the future.

455-464 PHILOSOPHY OF SCIENCE — THU., 16 FEB., 3 P.M./ SA COMMITTEE

455. A Theory on the Nature of Science. IRVING HAUPTMAN (State University of New York at Fashion Institute).

A theory in any area of human endeavor performs one or more functions. First, a theory can describe phenomena, providing it with a conceptual framework. Second, it can offer an explanation for certain events. And third, a theory can serve as a basis for prediction. In physical science the atomic theory does all three. In geology, the theory of plate tectonics explains such things as continental drift, mountain building and sea-floor spreading. While Veblen's theory of the leisure class simply offers a description of a particular social group. A theory is here proposed which will attempt to describe the nature of science as a method of inquiry by citing certain characteristics unique to it as well as some characteristics it shares in common with various forms of art.

Ernest Nagel, The Structure of Science (New York, 1961)
Quentin Bell, On Human Finery (New York, 1976).

456. Experts and Specialization: Vertical vs. Horizontal Differentiation of Science. JAMES R. BENIGER (Princeton University).

Despite the increasing prominence of experts in post-industrial society, their role has largely been ignored by social scientists. This paper outlines several approaches to the subject, including the historical development of the concept of "expert" in relation to structural differentiation, specialization of knowledge, and integration in society. Specialists are viewed as results of *horizontal* differentiation, experts of *vertical* differentiation. Historical evidence is presented that the words "specialist" and "expert" (and derivatives) first appeared at the time (1825-65) of the earliest division of intellectual labor, and that the former diffused more quickly through professions and areas of knowledge. The number of experts is shown to be proportional to the number of specialties, while the ratio of experts to specialists may be increasing, with implications that: (1) the importance of individual experts is decreasing; (2) the aggregate importance of experts as a group is increasing; (3) checks on the competence of experts are diminishing; (4) as scientific knowledge differentiates, its "generalist" component, ranging from popularizers to synthesizers, increases; and (5) reallocation in favor of new areas is increasingly restricted, while incentives for individuals to participate in these areas diminish.

457. Intensive drying: a study of anomaly in science. HAROLD GOLDWHITE (California State University, Los Angeles).

The actual way in which a scientific community reacts to anomalous observations or discoveries is of significance in discussion of how science progresses. The work of H. B. Baker on intensive drying, during the period 1880-1930 provides a case study of this phenomenon. Baker, who was a recognized pillar of the chemical establishment, claimed that by prolonged and careful drying of many materials, their physical and chemical properties underwent profound changes. By implication, the properties of pure materials were greatly affected by minute traces of water, a result which would contradict thermodynamic principles. At first Baker's work was supported and endorsed by other chemists, but further studies, and his own retirement from active chemistry, brought about a revision of opinion. Today orthodox chemical theory rejects Baker's work, but there remains, in the literature, an obstinate residue of unexplained observations.

458. The Inadequacy of Cause and Effect. ROBERT J. HEASTON

Cause and effect are necessary but not sufficient to explain the dynamic processes of nature. It is impossible to define any cause and effect relationship independent of some objective system. This statement is usually tacitly assumed as an a priori for scientific investigations. The implications of defining cause and effect in conjunction with an objective system are far reaching. Cause and effect do not have just a temporal relationship but also a matter and space association. Definition of an objective system embraces a given set of cause and effect contiguousness. Failure to define a closed or isolated system introduces external contributions to cause and effect. Design of experiments must confront the system-cause-effect interactions. The uncertainty principle and relativity theory will be used to illustrate the basic premise.

459. Self-organizing Systems in Chemistry and in Process Philosophy. JOSEPH E. EARLEY (Georgetown University)

In recent years, important progress has been made in understanding "dissipative structures", states of dynamic spatial and temporal order which arise spontaneously in certain (fairly simple) chemical and physical systems. In contrast to "equilibrium structures" which exist in closed systems, dissipative structures form (under far-from-equilibrium conditions) in open systems, and involve continual interchange of matter and energy with the surroundings. Alfred North Whitehead's "philosophy of organism" was much concerned with philosophical problems connected with self-organization.

This paper will demonstrate that concepts arising from the physico-chemical study of dissipative structures suggest useful reinterpretation of certain fundamental ideas of process philosophy (e.g., the relationship between "organisms", "societies" and "actual occasions"). It will be suggested that process philosophy and non-equilibrium thermodynamics can make important joint contributions to current philosophical discussion of complexity. Possible application of such concepts to currently-open questions related to biological evolution will be indicated.

460. Telecybernetics: The Overlooked Link Unifying Science and Law. C. ARTHUR MIHRAM (Haverford, Pa.), DANIELLE MIHRAM (Haverford, Pa.).

The term, "tele-cybernetics," was introduced by the senior author [AN EPISTLE TO DR. BENJAMIN FRANKLIN, Exposition-University Press, New York, 1975 (1974)] in an effort to locate C. West Churchman's CHALLENGE TO REASON [McGraw-Hill, New York, 1968]: his "hidden leadership" of America. The present paper places the search in the contexts of Science and Law by: (A) noting the historically proven power of telecommunicative media in pre-World War II Germany; (B) connecting thereto electrical engineer Norbert Wiener's suspiciously non-academic coinage (1948) of the term, "cybernetics," to mean other than "political science," the definition properly derived by the electrical scientist, Ampère (1834); and (C) showing that, in spite of the current concerns of many scientific officials regarding the Middle East, the unity of Science and Law can be, in any society guided by Reason, assured via tele-cybernetics: political science in our Age of Tele-communications.

The paper defines "academic freedom" as the right to pursue knowledge without topical constraint and "science" as the search for the very explanation of a naturally occurring phenomenon [cf. Kenneth Boulding, SCIENCE, 190, 423 (1975): "Science is a problem-solving subculture whose main value is truth"]. "Scientific freedom" becomes then the right to seek the very understanding of any naturally occurring phenomenon. "Tele-cybernetics" is thus a paramount responsibility of Science: a topic of scientific freedom and responsibility.

461.
Title: Belief and Forecast. MASON RUMNEY, (World Future Society, World Future Studies Federation).

Deep belief shapes reaction, habit, being, and creativity. It is shaped partially by assumptions or forecasts on the future. It then becomes expectation and forecast in decision-making, value formation, rigidity, and the basis for leadership and/or conflict. New potentials for forecast comparison can encourage the creative approaches called for by major belief systems and by emerging world circumstances. The responsibilities and temptations of forecasting priesthoods can be compared to those of religious leaders.

462. Tensors, Event Tensors, Graph Tensors and Invariant Forms In the Mathematical Expressions for Natural Phenomena. S.F. BORG (Stevens Institute of Technology)

This paper addresses itself to the question - What are the requirements governing the forms that must be taken by "laws" or equations representing natural phenomena as these are determined by various conditions of invariance?

To answer this question, a generalizing concept is developed in which the "tensor" of physical theory is extended to fields involving other natural phenomena.

The tensor of physical theory is, in this paper, simply called the "tensor", T. There are, as will be shown, two additional tensor quantities having all the mathematical properties of T but which differ fundamentally from it. These will be called "event tensors", E and "graph tensors", G.

The similarities and differences of the three families of tensors will be described in detail. In addition, examples of T, E and G will be presented from several fields indicating how and why they occur and what the fact of their existence implies.

463. Three Facets of Socialization: The Social Cube. J. Andre (California State University, Sacramento).

Social scientists have long been aware that one of the basic features of social life is found in the opposition of "Self vs. Other" and that this is linked, directly or indirectly, with a host of other important issues, viz. our self-concept, morality, cooperation vs. conflict, race relations, etc., but without further insights its promise remains unfulfilled. Psychopolitical theory suggests that the concept of "Self vs. Other" is made up of three, apparently equal and distinct components. The first is "Self vs. the Individual Other" which is implicated in morality and linked to the psychopolitical dimension of Power vs. Love. The second is "Self vs. Society" which is implicated in roles and rules and linked to the psychopolitical dimension of Freedom vs. Security. The third is "Self vs. Rational Social Thought" which is implicated in Popper's "World 3" and linked to the psychopolitical dimension of Rational vs. Irrational. These three components are orthogonal. Taken together and more generally known as "socialization", they make up the three dimensions of the Social Cube, which, at an abstract level, contains almost everything of interest in human social life, including political, moral and legal philosophies. Recent evidence has shown that the Cube can be measured, that it orders values, distinguishes social groups, and can "explain" most developmental and social theories. Hence it appears to be a viable possibility as a metatheory for the social sciences.

464. On the Inadmissibility of the Classical Hypothesis Testing Procedure FRANCIS R WATSON (Columbia, Missouri)

The classical hypothesis testing procedure, as developed by Fisher and extended by Neyman and Pearson, allows one to accept the least likely hypothesis, under certain conditions. Because there is no indication when this occurs, the classical procedure is considered inadmissible. In particular, this problem may arise in large samples, where $\alpha > \beta$. The null hypothesis is rejected because the observed value of a parameter is considered extreme under the null hypothesis. It may be, however, that this observed value is even more extreme under the alternative hypothesis. The rejection of the null hypothesis (and especially the acceptance of the alternative hypothesis) is clearly inadmissible in such cases. Yet, there is no admonition against this in the classical procedure. It is proposed that the correct measure of preference for accepting one hypothesis over another should be either the conditional probability or the likelihood ratio, depending upon whether the apriori probabilities are known or unknown, respectively.

465. Implications of a Changing Market for Federal Research Training Support in the Behavioral Sciences.* PAMELA EBERT-FLATTAU (National Research Council).

Between 1971 and 1975, doctoral production in the behavioral sciences grew at an average annual rate of 5.8 percent. At the same time, recent changes in such market indicators as enrollments and R & D expenditures suggest that the academic sector cannot continue to absorb new behavioral science Ph.D.'s at the same rate as in the past. Indeed, in 1976 less than half of the 4000 emerging behavioral science doctorates reported plans for employment in the academic sectors which may be contrasted with nearly 62 percent of the new Ph.D.s in 1971. Data from the 1976 NAS/NRC Survey of Biomedical and Behavioral Scientists indicate that the unemployment rate for 1971-75 behavioral science doctorates remains low, however, at an estimated 2.4 percent, and that these recent doctorates continue to find employment in other sectors.

For nearly 30 years, the NIH and the NIMH have provided an important program of research training support in the behavioral sciences, primarily at the predoctoral level. In response to a Congressional request, the NAS* has recommended a significant reorientation of this program of training, responsive to current employment conditions and imminent national research needs.

*Based on the 1977 Report of the NAS/NRC Committee on a Study of National Needs for Biomedical and Behavioral Research Personnel. Behavioral sciences include psychology, sociology, anthropology and related fields.

466. Implications of Recombinant DNA Research on the International System. RAYMOND A. ZILINSKAS, (School of International Relations, University of Southern California).

Recombinant DNA research has justly become a public policy issue. Until now little public attention has been focused on its possible international implications. Discussion in this paper will be limited to issues of immediate pertinence to both researchers and decision-makers: 1. Existing and potential legal control over research activity which could conceivably create new life forms hazardous to existing organisms; 2. The relationship of municipal law to international law in control attempts. Initially the paper discusses attempts to determine the degree of hazard. Two factors enters into this -- the measurement of risk and the judgment of safety. Next, the applicability of international law to hazardous activity is demonstrated with an emphasis on mishaps. It is shown that the situation is similar to those found in environmental cases, thus it is worthwhile to seek guidence from international environmental law. Classic cases in that area are traced, outcomes discussed, and lessons drawn. The application of several international Conventions to present and future research is demonstrated and the obligations which signatory nations have assumed are elucidated. Lastly, the assumed international obligations are related to the on-going process of formulating regulations controlling recombinant DNA research on the municipal level.

467. Legal and Ethical Implications of "Cost-Benefit" Decision-Making where Human Morbidity and Mortality are Concerned: How Various Federal Regulatory Agencies Deal with the Problem. THOMAS BOHAN and GEORGE COLLINS (Franklin Pierce Law Center, Concord, N.H. 03301)

Major actions now undertaken by Federal agencies, whether the licensing or construction of projects or the promulgation of standards, are now preceded by various types of analyses or assessments. These assessments are required by several statutes and executive orders, and generally require a balancing analysis of environmental, economic, health and other factors as justification for agency action. However, the elements of a balancing analysis are often incommensurate. In an attempt to bring about an orderly analysis, agencies are increasingly using cost-benefit and similar methods of analysis, and in the process, quantifying previously unquantified factors. The question arises, how does one proceed to place a monetary value on human life or health, granting that for regulatory purposes such a value must be placed? Furthermore, how does one evaluate or even consider unequal distributions of morbidity burdens among the population? These and related questions raise issues of ethics and individual values, as well as legal and Constitutional issues such as those of due process and equal protection. These questions are addressed, and an analysis is presented of the (often diverse) "cost-benefit" policies of seven Federal regulatory agencies, including NRC and EPA.

468. The Science Court or the Conflict-Clarifying Conference?--Two Approaches to the Problem of Resolving Scientific Controversy in the Making of Public Policy. DR. DON G. SCROGGIN (Yale Law School).

Technical and scientific information plays an increasingly important role in the making of public policy. Although legislators, public administrators, and judicial triers of fact are usually not well-versed in technical areas, these decision-makers are often required to pass judgment on conflicting statements of scientific fact upon which alternate policies rest, such as the danger of cancer from a food additive, the safety of nuclear power plants, or the environmental impact of fluorocarbons on the earth's ozone layer. Public policy decisions often require scientific facts that are in controversy and not yet determined with certainty. The Science Court proposal would use the legal adversary process to try to resolve the remaining disagreements among scientists. The Science Court proposal is examined in detail and compared with procedures now used for determining scientific facts in public policymaking. Criteria are developed for evaluating the usefulness of these procedures. A new procedure, the Conflict-Clarifying Conference (CCC), is proposed and shown best to satisfy the criteria developed.

469. Social Control of the Scientific and Technical Information System: Public Utility Regulation and International Transmission. P. DAVID VACHON (Franklin Institute Research Laboratories), STEPHEN FEINMAN (Gellman Research Associates, Inc.) and ALAN KRANING (GRA).*

* This work was supported by the National Science Foundation under Grant No. ERP 75-09110.

Evolution of the formal scientific and technical (STI) system into a largely-electronic form has raised the issue of whether this system ought to be operated as a regulated public utility. Likely consequences of attempts to enhance U.S. economic growth by regulating the STI exported through such a utility also were examined. As a basis for these assessments, the nature of the STI system, its role in the technological evolution of U.S. society and its likely all-electronic form were analyzed. Socioeconomic impacts likely to result from unified control of such an electronic STI system were projected. No constructive impacts were found.

470. Science Magazine and the Public's Opinion About Atmospheric Nuclear Testing, 1945-1965. F. M. O'HARA, JR., (Consultant in Technical Communication).

Research was conducted to determine whether the information published in the popular press about government-funded scientific activities produced any effects on the public's opinion about those activities or on the policy governing those activities. Reports concerning atmospheric nuclear testing published in magazines that were widely read by the American public were surveyed. A large percentage of those reports appeared in Science. The data were seen to be influenced by historical events, but American magazines as a whole were observed to slowly vacillate between pro- and anti-testing attitudes before finally adopting an anti-testing stand about 1957. Science was a leader in this trend. Comparison with public-opinion data on the subject indicates that there was a coincident, similar change in the public's opinion about the danger of such testing and that the media's shift preceded by about five years the general public opinion that such testing should be ended.

471. Government's Research Monopoly

Arthur B.Bronwell, University of Connecticut

Government's fiscal and managerial monopoly over university research leads to post-mortem rather than anticipatory search for knowledge. Specialists on governmental advisory committees excercise discriminating judgment, but they are entrained in the political system. The Vietnam War and the energy crisis arose out of: (a) inadequate perception of the changing world, and(b) irreparable delay in research on new energy sources. Both were in the character of post-mortem delays. An independent, pluralistic, competitive approach to research, bringing together a Congress of the Professions with substantially enlarged private philanthropy support for research,is one of several approaches that would be more in keeping with the character and intent of democracy,which will be considered. This presentation will examine briefly several alternative means of bringing research into better relationship with the realities of a changing world, as suggested in the author's forthcoming book : FREEDOM - The Future of Democracy.

472. Science & Technology Information for State Legislatures: Nuclear and Conventional Waste Disposal Problems.

JOHN G. MALINKA, SAMUEL F. HOHMANN (Minnesota Legislature Science & Technology Project).*

The need for science and technology capability in state legislatures has arisen for two reasons. First, a growing number of issues before legislative bodies involve highly technical questions. Second, legislators feel that the trend toward executive dominance of legislative bodies is due to a rapid increase in the number of experts in administrative agencies, while legislative staffs lack the capability to evaluate scientific and technical proposals and on-going programs. Defining issues in nuclear and conventional waste disposal (including solid, hazardous, radioactive, and sludge waste) illustrates how such a capability functions in Minnesota. The need for technical information in waste disposal decisions is presented. Barriers to using technical information in legislative decision making are addressed. Two of these barriers are: (1) legislators are elected for only two or four-year terms while information on siting, planning, and environmental impacts point to the need for long-range planning and evaluation; and (2) the voting public lacks adequate knowledge of the complexities of technical systems and yet seeks representation which supports programs that benefit them directly and immediately.

*Supported in part by NSF Grant No. ISP76-02379.

473. Ethics and Values in the Science of Economics.

ROBLEY E. GEORGE (Center for the Study of Democratic Societies).

The scope of public and professional discussion concerning the interrelationships among science, technology and society has broadened greatly in recent years to encompass a range of issues that necessitate reconsideration of the ethical and values implications of scientific activities. Further, the nature, complexity and seriousness of contemporary societal problems strongly suggest that, one way or another, science and technology will in the near future become even more active in contributing to the formulation of public policy consistent with scientific understanding of global constraints on human activity. In particular, there exist many indications that major modifications of existing economic systems -- affecting all society -- may be imminent. Clearly, myriad minor economic system adjustments are continually studied, proposed or supported by practicing economists. This paper explores some of the ethical and values issues associated with the science of economics in the context of contemporary society.

474. The Joint Research Centre of the Commission of the European Communities: its role, its programme.

J.P. CONTZEN, Director of Programmes, Joint Research Centre of the European Communities.

The paper concentrates on the special role which the Joint Research Centre has to play within the complex R and D structure of the Community: its in-house research activities are aimed at fulfilling a central role in support of the policies of the Commission, a role of catalysis for actions of Community interest, a role of provider of facilities and services accessible to laboratories and industries of all member states.

The selection of research programmes derives logically from the role entrusted to the Joint Research Centre, ranging from nuclear safety to reference measurements and standards activities and including future energy sources and environmental protection. These programmes are described in their essential features. Some problems encountered in the execution of such programmes are discussed: the adaptation of the researcher competences to the evolving nature of programmes, the correct evaluation of the result of research activities, the transfer of these results to the public and industrial sectors for further development.

475. Priorities for Coping With Global Problems: How Effective Are Various Policies?

WALTER H. CORSON (World Population Society, Washington, D.C.).

An analysis of desirable and actual policy priorities for coping with the "world predicament", including the interrelated problems of poverty, hunger, disease, population growth, resource shortages, inflation, unemployment, and war. From an inventory of over 300 policy options for relieving problems in 14 problem-areas, the paper evaluates and ranks 21 options for their potential positive (problem-alleviating) and negative (problem-intensifying) impact on each problem-area. Policies rated as most effective for controlling the overall world predicament include: reduce population growth, develop solar-related energy sources, conserve energy, increase aid to rural development, improve land-use management, and increase institutional capacities and public support for action to control global problems. The ranking of desirable policies is contrasted with actual world priorities as reflected by current budgets of nations and of organizations such as the U.N., and by surveys of elite and public attitudes about world problems. For example, reducing population growth, developing solar energy, and conserving energy are rated among the most effective policies, but world spending for each of these is less than 1% of expenditures for priorities such as education, defense, housing, health, agriculture, and transportation. The paper considers strategies to alter current world priorities and increase support for policies with major potential for alleviating the world predicament.

476. **Placement of the Calculus: The Issue as Seen in the Literature. DIANE M. SPRESSER (James Madison University, Harrisonburg, Virginia 22801).**

Historically, calculus has enjoyed a close relationship with engineering and the physical sciences, with much of the calculus actually growing out of attempts to solve engineering and physical problems. Because of this close relationship, physical scientists and engineers frequently advocate an early teaching of the calculus. Since its inception into the American curriculum, calculus has been and continues to be primarily a college/university level course. During the 1960's, however, elementary calculus increasingly became a part of secondary school mathematics offerings. Despite its popularity, high school calculus continues to be the subject of considerable controversy. This paper investigates the issue historically through a review of major studies in the literature, indicating that the actual content of the high school calculus course may be of limited value.

477. The Importance of Displaying Chemical Phenomena in the Classroom. BASSAM Z. SHAKHASHIRI, GLEN E. DIRREEN and LLOYD G. WILLIAMS, Department of Chemistry, University of Wisconsin-Madison, Madison, Wisconsin 53706.

Lecture demonstrations are useful for the purpose of both displaying chemical phenomena and illustrating specific principles. Successful incorporation of demonstrations into lecture presentations is essential for stimulating student interest in chemistry and for provoking curiosity about chemical phenomena. In this presentation we will describe our recent efforts in compiling and developing over 100 demonstrations suitable for use in undergraduate chemistry courses. Also, few selected demonstrations will be shown. Safety aspects will be discussed.

478. Space Exploration: New Themes for Multi-Disciplined Education. LEONARD W. DAVID (Forum for the Advancement of Students in Science and Technology, FASST)

Space exploration provides a new and unique educational tool to stimulate the classroom learning process. The "humanization" of space is an innovative format in increasing the students understanding of a variety of disciplines, ranging from biology and physics to anthropology or sociology. Such space programs as the search for extraterrestrial intelligence offer a case in point. The search for alien life is based upon the complexities of our own, earth developed, technological, biological, and cultural processess. It is an understanding of these earth-based criteria that are tantamount in gaining a realistic perception of the search for other "intelligent life forms" in the universe. Space settlement projects, housing large populations, offer to the educator an opportunity to enhance established curriculum including architecture, psychology, agriculture, as well as economic, legal, and political systems.

479. Early Astronomy and Geology in Britain - A Travel-Study Course. T. SCOTT SMITH (Dickinson College), LISA ROSSBACHER (Princeton University).

This experimental Dickinson College Summer School course was successfully given during June and July 1977 to students with no required background in either specialty area. One week was spent on preparation in the U.S.A. and five and one-half weeks in touring Britain. The relatively small size of Britain, its variety of rock types and landforms and its abundance of megalithic astronomy sites make it an ideal area for stimulating interest in the subject areas. Archaeoastronomical sites such as Stonehenge, Avebury, Long Meg, and Castle Rigg spurred discussion of possible alignments - man made vs. natural foresights, the place of astronomy in ancient cultures, and lithology of the stones. Geology was taught by the "hands-on" approach at sites ranging from Siccar Point to Loch Ness to Land's End to the Isle of Wight. This was reinforced by geological museum visits. The students were encouraged to apply their geological knowledge to the megalithic monuments, in order to discuss possible provenance of the stones and to differentiate between natural weathering and man made alterations to the stones.

480. The State of Geography in the State of Maine. John Damron (University of Maine at Farmington).

Geography, one of the first sciences, is little taught in Maine at any level, elementary through University. For reasons that are historic, geography probably has fewer practitioners in Maine than in any other state. There are five fulltime academic geographers in Maine, and only one institution of higher education offers a major in geography. Few secondary schools offer geography as a distinct subject, although it may be included as part of a Maine studies course. A small number of geographers are employed in Maine State Government, especially in the Maine State Planning Office, and in private enterprizes that deal with environmental analysis.

481. Structuring Attitudinal Changes Toward Ethical and Moral Issues in Human Genetics Through Personalized Student Instruction. PAULINE GRATZ (Duke University Medical Center.)

Course is basically concerned with ethical and moral issues surrounding mandatory screening, therapeutic abortion, prenatal diagnosis and genetic counseling. Course is open to nursing and other interested students. No prerequisites are required other than the university natural science requirement. Essence of course involves class discussion of problems and not the teaching and/or review of basic genetics. Cognitive objectives are achieved by means of self-study material which provides a combination of learning experiences in an integrated sequence so that each learning activity enhances and complements the discussion. Class discussion is facilitated through the use of slides, slide-sound programs, audiotapes, films and case studies. Students submit a weekly log with social security number only, to enhance freedom for ventilation of feelings and thought without threat of evaluation. A pre-hoc and post-hoc questionaire is administered to determine values clarification and attitudinal changes pertaining to ethical dilemmas created by genetic advances. The course successfully deals with attitudes and values by utilizing Personalized Student Instruction in order to allow the greatest freedom for discussion of moral and ethical problems using informed data base rather than "gut" level reaction.

482. A Unified Approach for Teaching Bioethics to Undergraduate Science Majors. JUDITH C. ZOLA, Ph.D. (Ramapo College).

Although Bioethics courses have begun to appear increasingly in medical school and graduate science curricula, they are still very much peripheral to the education of physicians and scientists. If sensitization to the ethical and human value implications of the practice of science and medicine is a desiratum, such a process should begin in the undergraduate years. This paper asserts that traditional programs for science majors result in a trained insensitivity to social and ethical issues implicit in the subject matter or laboratory procedure at hand. The author's experience in teaching Bioethics courses suggests that such separate course offerings are ineffective in leading individual students to an awareness of the ethical implications in their own work. A proposal is offered for modifying the syllabi of traditional science courses so as to include direct confrontations with the issues implicit in each area of study. The presentation will expand upon this technique.

483. Moral Dilemma and Moral Reasoning Levels in Science Curricula. RICHARD LOWELL Ed.D. (Ramapo College)

It has been asserted that the traditional curricula for the training of scientists and physicians produce a trained insensitivity to the social and ethical issues implicit in the subject matter and laboratory procedures. While new courses in Bioethics or modifications of existing curricula may reverse this trend, attention must be given to the students capacity and inclination for moral reasoning. The work of Kohlberg and Piaget suggests a developmental sequence for moral reasoning. A mismatch between the learner's developmental stage and the level of ethical reasoning demanded by the curriculum is undesirable. Strategies for avoiding this mismatch are suggested.

484.

Teaching Science-Value Issues to Undergraduates

YOLE G. SILLS (Ramapo College)

It is felt that a propitious time for developing the awareness of scientists concerning issues of scientific responsibility is during their formative undergraduate years. It is also felt that the exploration and systematic analysis of these issues is equally crucial for students majoring in other fields who, as members of the general public, will be confronted with choices among competing advocacies. Education in science-value issues is an important aspect of the public understanding of science which, in turn, has important consequences for science policy.

To what extent do undergraduate curricula address these issues specifically? This paper reports upon the prevalence of relevant teaching based upon current inventories of courses in the science,technology,and society field.

485. Commonly Cited Literature in Introductory Educational Psychology Texts and Anthologies.

WILLIAM E. ROWETON (James Madison University), MARILYN KOEPKE ROWETON.

Over 50 recently published introductory educational psychology textbooks and anthologies were surveyed to determine what theoretical and experimental literature is more frequently referenced. Literature citations were obtained by examining each volume's footnotes and reference sections. Frequency counts ensued for books, review/theoretical articles, and experiments as well as for the relative contributions of particular authors, journals, and subject content. Commentary (e.g., research methods, data analysis techniques, type of subjects utilized) about frequently cited experiments augment the discussion of results. In short, this survey permits an empirical statement as to what literature is commonly incorporated in introductory educational psychology and, by implication, what is not utilized from the rich body of human psychological literature. Implications, especially for teacher training, are offered in conclusion.

486. Population Trends: A Visual Presentation.

LEON E. CLARK (Population Reference Bureau), ANDREW J. LEIGHTON (Population Reference Bureau).

Visual materials - charts, graphs, tables and diagrams - are an important part of population studies. To assist educators, the Population Reference Bureau has produced three sets of slides based on its popular chart series.

It has also produced slides of all graphic materials that appear in its bimonthly Population Bulletin, a standard reference work in the field of demography.

The presentation will introduce viewers to an important educational resource which contains subjects relevant to both the United States and the world. Topics include population growth, birth and death rates, urbanization, energy production and consumption, immigration, status of women, and marriage and divorce.

487-497 EDUCATION (OPPORTUNITIES) THU., 16 FEB., 3 P.M./ SA CABINET

487. Performance of Pre-College Handicapped Students in Field Aspects of Marine Science.

E. C. KELLER, JR. (West Virginia University) and HELEN E. KELLER (West Virginia University).

In the summer of 1977 the first National Science Foundation SSTP (Student Science Training Program) for the handicapped was held at the Marine Science Consortium's Wallops Island, VA., station. The program consisted of 23 handicapped students (11th and 12th grades) ranging from total blindness, total deafness, and wheelchair bound to partial blindness, partial hearing, and moderately restricted mobility. The students received experiences in marine biology, oceanography, coastal ecology, and the scientific method.

Considerable peer interaction was observed in both academic subjects and communication skills (e.g., signing was taught by the partially deaf to the orthopedic, blind, and partially sighted participants).

The results from the preliminary academic evaluations, shown in the table below, tend to indicate that the total/profound deaf and the orthopedic participants academically scored lower than the other groups. This might be due to the fact that these two groups were not tested on the same communicative level as the other students, or that there were too few students in each group, or the academic input from the staff was not optimally communicative for the unique types of handicaps. Undoubtedly, all three of these mechanisms were in operation during the program, however, further experience is needed in order to more precisely ascertain the causes of the discrepancies among the life function disability groups noted in the table.

Type & Degree of Handicap	N	Average Performance
Deaf (total/profound)	11	18.0
Partial hearing	4	13.0
Blind (total)	3	13.7
Blind (partial)	2	11.5
Orthopedic	3	17.3
Overall	23	14.7

(1) A low score is good; a high score is poorer.

488. An Interdisciplinary Model for Training Day Care Personnel and their Trainers.

ROBERT DEITCHMAN, ISADORE NEWMAN, JEAN WILLIAMS, RUTH ROBERTS, PAT TURNER, HARRIET HERSKOWITZ, MARY ELLEN ATWOOD, MARTHA LEYDEN, PAT McCLENDON, (University of Akron).

Professional growth of all members of a day care center staff is a major factor in the quality of the program, its development, and implementation. In order to respond to the dynamics of child behavior as well as necessary changes in curricula, continuity of staff development needs to be achieved through a number of processes. One of these processes is in-service training workshops. In order to provide the opportunities for professional growth and development, training programs need to be constructed which allow staff members to explore all phases of day care service delivery. Necessary components in such workshops include: (a) planning and evaluation, (b) observation and assessment, (c) equipment and materials, (d) self-evaluation, (e) administrative duties, and other areas as well. Because of this diversity, variations in method and format are recommended in planning and presenting in-service training. This paper discusses a funded program which developed intensive in-sercice training for groups as well as individuals aimed at promoting competence in the staff member to insure quality in the day care programming.

489. A Demonstration Project Using an Integrated Evaluation Model as a Continual Process in the Training of Day Care Personnel and their Trainers. ISADORE NEWMAN, ROBERT DEITCHMAN, JEAN WILLIAMS, RUTH ROBERTS, HARRIET HERSKOWITZ, MARY ELLEN ATWOOD, MARTHA LEYDEN, PAT McCLENDON, PAT TURNER, DAWN DIEZMAN (University of Akron).

This paper presents the philosophy, theoretical position and value of an in-service evaluation process model with data from a demonstration project consisting of 24 day care centers. Evaluation was used in this project as a facilitator, a teaching device, and as an initiator of change as well as a means of assessment. It was an integral part of the in-service training model, from its inception. These facts created an atmosphere of accountability which increased the incentive for being more thorough and specific in program development. This model would be useful regardless of the content or service training program involved. In the conclusion of the paper a schematic diagram is presented along with data that supports the effectiveness of the model and a discussion of the evaluation process, its component interrelationship along with its application, implication and suggested use.

490. Factors Attracting Women to Math and Science. PATRICIA L. CASSERLY (Educational Testing Service).

This paper reports on the factors found to be concomitant with Advanced Placement Programs in secondary schools that have been remarkably successful in attracting and holding young women in college level courses in mathematics and the sciences in a study funded by NSF.

Professional careers in mathematics and the physical sciences are, on the whole, open only to those college students who pursued the sustained study of these subjects in secondary school. Relatively few girls take advanced high school science and mathematics courses; the majority therewith cut themselves off from college programs--and hence future careers--in these subjects even before matriculation.

A further investigation of factors that encourage young women to pass through the critical filter of mathematics in secondary school is now in progress and will also be discussed.

491. A Path Analytic Explanation of Women's Participation in College Mathematics. LORELEI R. BRUSH (Abt Associates Inc.; Wesleyan University.)

The purpose of the presentation is to describe and defend a model which explains the lower level of participation of women in college physical science courses. The technique of path analysis is used to join the variables of gender, ability, attitudes toward and anxiety about mathematics, and expectations about future course experiences in explaining students' involvement in mathematics and physical science. Two studies are summarized, the first in which a model is presented and tested, the second in which the model is replicated through the use of a second sampling and more extensive data collection.

492. Report on a Project Designed to Encourage Women to Study Mathematics ALICE T. SCHAFER (Wellesley College).

Difficulties with mathematics or a dislike of mathematics and consequent avoidance of study of the discipline are common among college students, both male and female. Studies have demonstrated that women are even more seriously affected than men. In the past two years the Mathematics Department at Wellesley College has been developing programs for reducing anxiety about mathematics and remediating mathematical skills when necessary in order to encourage students to enter regular mathematics courses and mathematics related careers. The Project has four components. The first is the development of a one-semester course entitled "A Discovery Course in Elementary Mathematics and its Applications", which is designed for women students who had planned to take no mathematics courses or courses requiring quantitative techniques in college. The course contains many components not found in traditional mathematics courses: a two-hour weekly laboratory period; a lecture series featuring women professionals who use mathematics in their careers; materials which stress the applications of mathematics in the humanities and social sciences and a teaching method designed to decrease mathematical anxiety in the students. The other components of the Project are: the offering of four-week courses in precalculus, and in preparation for the professional exams, and an evaluation by a psychologist working with staff members and the students in the courses.

493. "Science, Sex, and Society": a Course to Encourage Women in Science. CHERRY GRANROSE, ANN E. KAMMER, and JAN B. SLoan (Kansas State University, Manhattan).

To encourage women to enter scientific careers and to counterbalance social pressures that limit women to domestic or other stereotypically feminine roles, we have developed an introductory course, "Science, Sex, and Society." The course includes: (1) a consideration of the history of women in science, (2) conversations with contemporary women scientists, (3) discussions of sex bias in scientific research, training and career patterns, (4) exploration of routes and resources for becoming a scientist, (5) laboratory experience with scientific equipment, and (6) assessment of personal skills and career values. Reading materials have been collected and evaluated for student interest and usefulness in changing stereotypes. An effective teaching technique used was small-group discussions involving individual scientists with different interests and life-styles. Preliminary assessment of the efficacy of this course in changing student attitudes towards careers in science suggests that stereotypes can be modified by such a course. (Supported by a grant from the Office of Education, Women's Educational Equity Program).

494. EQUALS: A Teacher Training Project To Promote Sex Fair Mathematics Instruction and Counseling. NANCY KREINBERG (Lawrence Hall of Science), RITA LIFF (San Francisco State University).

While girls are as gifted as boys in mathematics, many lose interest and motivation in math as they progress through the elementary grades. In addition, young women often stop taking math as soon as it becomes optional in high school, thus screening themselves out of many educational and career options in the future. The EQUALS project at the Lawrence Hall of Science (LHS) aims at early intervention in this pattern of math avoidance by working with teachers and counselors serving grades 4-9 in the San Francisco Bay Area. Forty teachers attended a 15-day summer institute at LHS, where they were assisted in adapting materials for building positive attitudes toward mathematics and relating math to future career choices. During this academic year, EQUALS participants are meeting monthly at LHS to assess their progress in using institute materials and planning for dissemination of EQUALS activities in their schools and districts. Extensive evaluation is being carried out on the impact of both the training institute and the effect of this intervention program on female students' attitudes toward mathematics.

495. Role Models for Future Women Scientists. ANN BENHAM (The University of Texas at Arlington).

Seeing is believing. Role models are the best selling medium to encourage women to pursue challenging science careers. There are many successful women scientists who can serve as excellent role models. It is nearly as simple as "If she can do it, so can I; she is enjoying this challenging, stimulating career; I really should explore this area." Success is encouraging, inspiring and contagious. Young girls need to be exposed to these dynamic women. This exposure can be accomplished via videotapes, interviewing the women as they are performing interesting, enlightening scientific work. The women interviewed are dedicated, conscientious professions reflecting a variety of life styles, not superwomen. Young women need to have mental pictures of these successful women scientists as they dream and plan their life's work. Our traditions and culture stereotype professions to such a degree that many young women never consider many of the really exciting and challenging careers: Observing a woman intrigued by her work will broaden the horizon and open up a whole new world. It will create the attitude that "I can be anything I choose; the sky's the limit!" This project on the utilization of role models was supported by a grant from the Office of Education under the Women's Education Equity Act.

496. Information Usage in Late Life. PAUL A. SALISBURY (New York Univ. Medical Center), ROSE S. BEER (Adelphi Univ.).

The role of information needs and the means of satisfying *these needs in old age, were explored* in a recent survey of 140 residents (ages 60-94) in two domiciliary care facilities. All of the respondents were queried as to: if and how they cope with various information needs, how they recently utilized health information, how they prefer to receive social-health service information. There is a perceived need for information about current events and social-health services among older adults. Mass media sources, especially the print media, were the preferred mode for satisfying information needs,e.g. local news, health information. The electronic media were less desired as resources but all of the media were generally preferred over interpersonal sources as means of satisfying needs. Older adults also prize 'the life of the mind'; they need to think as well as to feel and to interact with others.

In terms of relative importance, our survey found several information needs ranked above social needs e.g. being with one's family.

497. The Advancement of Science Abroad: The Case of the Lost Foreign Alumni. EDUARD BOER (University of North Carolina - Chapel Hill), JILL STRITTER (University of North Carolina - Chapel Hill).

In 1975 about 220,000 foreign nationals were enrolled as regular students in undergraduate and graduate programs in U.S. colleges and universities. To assess present involvement and interest and to develop a model for continuing *relationships between host institutions and their foreign* alumni, the AID/NAFSA liaison committee funded a Foreign Alumni Study Project. A final report is scheduled for publication in early '78. Preliminary results include: 1) little is known about the perception, evaluation, and use of the American education of foreign alumni. 2) in general, maintenance of relationships with foreign alumni is scattered at the individual level and uncoordinated or absent at the departmental, college or institutional levels. Some characteristics of a model for future use by U.S. institutions are 1) justification for involvement with foreign alumni, 2) criteria and suggestions for establishing and developing alumni follow-up abroad, and 3) reduction of non-return and return adjustment problems. The scientific community by maintaining international scholarly relationships with its overseas alumni can and should express its responsibilities in the light of growing international concern, awareness, and development.

498-507 EDUCATION (GENERAL) FRI., 17 FEB., 9 A.M./ SA CABINET

498. Draws and Wins in Master Chess: 1851-1972. ERNEST RUBIN (University of the District of Columbia and American University).

This analysis explores trends in wins and draws in master chess tournaments and world championship chess matches during a period of about one hundred and twenty-five years. A variety of reasons are suggested to explain the changes in the relationship between wins and draws. Finally, an indication is offered regarding foreseeable trends in master chess outcomes. This analysis is based on (1) an examination of game outcomes in world championship matches (1857-1972), (2) a sample of game outcomes in 14 master chess tournaments (1867-1970), and (3) a summary and incorporation of tournament results developed by earlier investigators.

499. Costs and Values of Education Systems
Milton A. Grodsky
University of Maryland University College

The need for a model or models of educational systems to serve not only as a framework for the application of educational research but also as a decision-making tool has been emphasized in the past. Part of such a model must include some process by which various educational alternatives can be rank-ordered. Important in this process is consideration of the costs and values of various educational alternatives. This paper discusses a process of rank-ordering various educational alternatives in terms of three value categories and two cost categories. Example of how such a process would operate in the development of an actual curriculum is presented.

500. Longitudinal Preventative and Cost Effective Impact of INREAL (Inclass Reactive Language Therapy): an Innovative, Generalized Learning Model. RITA S. WEISS (University of Colorado).

Data will be presented on a three year study of 107 preschool and kindergarten children, half receiving INREAL prevention treatment (experimentals) and half matched controls. Slides will show traditional pre-post screening comparisons utilizing the FIPS (Fluharty-INREAL Preschool Screening Test), a discrete language skills measure. A third year generalized learning data slide will list school district itinerant special services and grade retentions received by the matched groups and will show that significantly fewer such remediations were required by experimentals:

Analysis #1: $x^2 = 6.187$, p .05
Analysis #2: $x^2 = 7.38$, p .01
Analysis #3: $t = 4.354$, p .01 @ df = 60

Included will be slides on comparative program dollar costs for three years and projected district dollar savings resulting from the INREAL early intervention language therapy program. The discussion will focus on the data treatment as an innovative model for analyzing the longitudinal impact of a reactive language intervention program.

501. Validating Optimal Response Modes of Learning Disabled Children. TOMMY W. ALLMAN, ANTHONY D. HALL, MELVIN M. WHITE, LINDA J. PEYTON, and JOHN T. BRAGGIO (University of North Carolina at Asheville).

It has been shown (1, 2, 3) that knowledge of optimal response modes can be used to predict success or failure of learning disabled (LD) children on academic tasks. In this two-part experiment optimal response modes were determined using a similar analysis, but with another diagnostic test, the Illinois Test of Psycholinguistic Ability (ITPA). The results of the first experiment indicated that LD children demonstrated individual or multiple combinations of covert-, vocal, or visual/manual-response modes and that the least effective mode could be predicted from knowledge of the optimal response mode. In the second experiment, a stepwise regression analysis showed that the optimal response mode factor was more important than even the psycholinguistic age score obtained from the ITPA in explaining the variance for the recall scores obtained on a paired-associate task. These cumulative results underscore the potential use of optimal response modes as an aid in the diagnosis and remediation of the educational handicaps of exceptional children.

1. Owen, J. A., Braggio, J. T., & Ellen, P. J. of Learning Disabil., 1976, 9, 30-37.
2. Braggio, J. T., et.al. J. of Learning Disabil., 1977 (in press).
3. Braggio, J. T., et.al. Proceedings, AAAS, 1977, 143, 360.

502. Student Scientists. DEAN HARPER (University of Rochester).

During the summers of 1976 and 1977 about 100 undergraduate students conducted individual research projects in laboratories, or in field settings at one northeastern university. In order to study the process of students becoming scientists, whereby they learn both the values and the techniques of scientific work, I observed these students at work and interviewed them. Their research experience became the cutting edge for determining who would go on into science. It also provided an important apprenticeship that gave them a close understanding of the life of a scientist, and frequently started them on a career in science. Working on a project in a faculty member's lab, the student saw himself or herself as an accepted scientific worker--albeit a very junior one. Doing his or her own research project, the student typically either developed a strong commitment to science, or turned away from research for other less demanding careers. Socialization for science and scientific work occurred in several interesting ways, and in ways that could not be achieved by either taking science courses or by working as a teaching assistant in such courses.

503. Altering Cognitive Styles of Nonscientists through Short Drills. WILLIAM E. MOORE (Norfolk State College).

A seemingly elusive dilemma which confronts the science teacher is that of presenting a palatable but intellectually honest version of science to the nonscientist. Indeed we find this problem to be real, in spite of the existence of advances in instructional technology and other gimmicks designed to motivate persons with minimal interest in science. In response to a specific problem we encountered with metric awareness, we have developed a highly effective drill procedure which does not consume significant amounts of time but which has the potential to alter the cognitive styles of nonscientists. At a maximum students are subjected to scientific awareness exercises which require no more than an average of 3 minutes per class period or 2 hours per semester. The results were overwhelming; students acquired a greater "feel" for what they were doing as well as an increased facility for doing it. The results from these exercises will be discussed in relation to how this approach can be used to bridge gaps in the conceptualization process of nonscientists.

504. Evolution of a Practicum for Biology Teaching Assistants. WITKUS, E.R. (Fordham University) VERNON, GRACE M. (Fordham University) LYNCH, MARY E.(Manhattan College).

To overcome obstacles encountered by first year Teaching Assistants, the Biology Department designed a graduate course in instructional methods. All students awarded Teaching Assistantships must participate in a one semester practicum. The course follows a seminar format. Guest experts in instructional development are invited to lead seminars in their area of expertise, e.g. guided design, A-T, PSI, compressed speech. Students critique the various instructional methodologies and present a topic using one of the instructional formats. Methods of student, teacher and course evaluation are included in the program.

505. Information Processed in Written Assessments of the Quality of the Environment. J. W. MOSER (University of Pittsburgh)

This investigation was done to measure the structural quality of assessments of the environment written by 142 secondary school Ss. They were randomly selected from low and high academic programs. Assignments were validated by performance on two batteries of operational tasks. Each S wrote a free-prose passage on "what do you think about the environment" (15 minute duration). Lexical terms (nouns) and relevant pronouns, of each passage sequence,were used to obtain information data (32 theorems). Discriminant analysis results revealed four information theorem functions (REAL:M^1, LTM, H (Y)SS; H (X,Y)SS) significantly separated swarms for the age (13-17 yrs.) and ability of Ss (Wilk's Lambda, F-value approximations at the .001 level). Correct a posteriori classifications (Mahalanobis' Statistic) of Ss in trait groups ranged from 37-75%. Significant forecasts of the abstract reasoning ability of low ability Ss had best-fitting equations of H (Y)SS, REAL:SS, LTM, and ENCODER information at the M^1 state level. The best-fitting equations in forecasting reasoning ability of high ability Ss were of H_Y(X)SS, ENCODER information at the M^4 and M^{16} levels, and H (Y)SS. It was concluded Ss of different ages and levels of mental ability differ in amounts and kinds of information processed in prose assessments of their environment. This is a major discovery because the technique validly quantifies different qualities of opinions on social problems, such as that of the environment.

506. Health Education:Panacea, Pernicious or Pointless? ELLEN COHEN(NYC Bd. Educ.), CARL COHEN(NYU Med Ctr).

With the escalation in expenditures for medical care, there has been increased emphasis on primary prevention and, more specifically, health education as long-range solutions. Before embarking upon costly federal programs several important issues must be considered:(1)Despite optimistic claims for health education, a review of previous research indicates current methods have produced only meager success in transmitting information;(2)Moreover, there is less support for a correlation between acquired knowledge and desired behavior;(3)The health education approach, with its emphasis on the individual and the minimization of sociocultural effects, has been viewed as "victim blaming;" this orientation can have pernicious consequences for poor and minority groups. Utilizing data from a study of 3000 inner-city and suburban junior high school students' responses to a new health education topic("Improving the Outcome of Pregnancy"), the authors provide additional empirical support for the relative ineffectiveness of current educational methods and their potential dangers.

507. Interested in Geriatric Medicine: Why? PAUL A. SALISBURY, BRENDA BLACK, JOSEPH A. STEWART, LINDA LIBOW (New York University Medical Center).

Given the need for geriatricians, and physicians who also focus on geriatrics within their practices e.g. internal medicine, family practice, it is important to learn who is attracted to a program in geriatric medicine and why. The subjects of this report were first and second year medical students who applied for a summer program in geriatric medicine in 1975, 1976 and 1977. The data consists of questionnaires, observations, and letters of application. Some initial hypotheses about the applicants were not supported by our analysis. Few of the students applying to the program had any tangible knowledge of gerontology; a strong relationship with a grandparent also was not a significant factor. The students evinced a strong interest in primary care and they anticipated practices with large proportions of elderly patients. Also, the program was seen as desirable clinical experience, an early chance to be with patients in a therapeutic situation. Their entry perspective was essentially practical rather than ideological in orientation.

508. A Three-Dimensional Array Used for Determining The Coefficients of Expanded Trinomials. MICHAEL LENTZ (Mount Pleasant High School).

In conducting my research, I sought to find an array of numbers which could be conveniently used to find the coefficients of the terms of trinomials raised to positive integral powers. Using inductive principles and Pascal's Triangle, through thorough examination of the coefficients of expanded trinomials and by attempting to find some symmetry associated with their occurrence, I was able to develop such an array. The three-dimensional array that I have developed demonstrates that all coefficients of a trinomial expression raised to a given positive integral power are representative of a sum of one, two, or three of the coefficients of that same expression raised to the power one less than that given.

508A Mechanics of Rubber. Peter A. Sandborn (Fort Collins High School).

For rubber powered aircraft it has been found that certain specific samples of rubber greatly improve the flying ability.

The present experiments were directed toward the understanding of the initial part of the change of torque as rubber strips were twisted. Use of Saint Venant's theoretical torque prediction shows that the relation holds true for only very small values of torque. The theory must be modified to include shear effects when the rubber strip width is large compared to the thickness. An experimental correction for the shear effect was obtained.

From Poisson's ratio measurements it was found that the ratio is not constant. Poisson's ratio increases as the cross-sectional area of the rubber decreases. The ratio decreased as the strain increased. Using the theoretical relation for the non-linear stress-strain curve it was possible to evaluate a modulus of elasticity for rubber. The variation of Poisson's ratio does not allow a unique value of the modulus of shear to be determined.

Friction measurements were also made for the rubber strips. It was found that dry lubricants (graphite, talcum powder) decreases the coefficient of friction more than wet lubricants (soaps). Data on the rubber's deformation, while being stretched by weight, with time was obtained.

509. A Digital Computer Simulation of the Effects of Various Stresses upon Cardiovascular Dynamics. ANNE FULLILOVE (Highland High School, Albuquerque, N.M.).

This study provides an explicit, verifiable model of the effects of various stressors upon cardiovascular dynamics. The method required the construction and validation of a series of increasingly complex computer programs which simulated various characteristics of the human circulatory system. This model was implemented on a PDP-11/34 computer system. The various models were validated by comparing their output with results reported by Guyton (1973). These outputs ranged from normal functioning of the various components of the various models through such pathological states as 1) dehydration of the organism through the decrease of extracellular fluid volume; 2) hemorrhagic shock through a decrease in circulating blood volume; 3) Goldblatt hypertension (from a reduction of renal mass) and 4) exposure to prolonged weightlessness wherein systemic arterial pressure is decreased as a result of a decreased peripheral resistance, which, in turn, is brought about by a decreased total blood volume resulting from a zero gravity environment. All of these conditions except that of a zero gravity environment have been simulated by Guyton. The simulation of cardiovascular effects of prolonged zero gravity conditions has not been reported in the literature. The results of the simulation of the cardiovascular system's response to prolonged functioning under zero gravity compared well with the actual results of such conditions.

510. Gas Chromatograph Analysis of Ethylene Production as a Function of pH. STEVEN MICHAEL ESTOK (Western Kentucky University).
Many people claim to gain relief from arthritic pain by wearing copper bracelets. Methionine, an amino acid, is present on the skin and contains the ethylene structure. Copper may react with methionine to liberate ethylene, which could be absorbed, or copper atoms could be absorbed and react with methionine in body tissue. If ground metallic copper is added to methionine solutions of varying pH ranges in the presence of oxygen and the anesthetic gas ethylene is produced in sufficient quantity to be measured by the Gas Chromatograph (FID), then no difference will exist in ethylene production at various pHs. Buffered methionine solutions of pH's 3.8, 5.8, 7.8 and 9.8 with copper and oxygen were incubated at 37°C. Analysis of the gas samples indicates production of ethylene at all pH levels. Analysis of Variance (CRD), indicates a significant difference between the high and low treatments. Duncan's New Multiple Range Test reveals a difference between the highest mean and all other means. Gas Chromatograph-Mass Spectrometry confirms ethylene production. Ethylene gas is produced in controlled laboratory tests, thus ethylene might be produced on the skin or in body tissue in sufficient quantity to relieve pain.

511. Personal Space and Nationality: A Regulator of Nearness? ANA NUÑEZ (Altoona Area High School)

The primary hypothesis of this research is that the nationality of individuals affect the amount of personal space they require. Specifically, individuals of Western European descent need less space than individuals of Anglo Saxon-Eastern European descent. To determine the amount of individual personal space needed, individuals ranging in age from twelve(12) to eighteen(18) years were surveyed in public areas. The survey consisted of four parts: (1) background information including nationality, (2) person to inanomate object space, (3) person to person space without eye contact and (4) person to person space with eye contact. The results of the survey indicate individuals of Western European descent require the least amount of personal space. Individuals of Anglo Saxon-Eastern European descent emerged as two distinct groups, the Anglo Saxon-Eastern European(I) having no aversion to physical contact but requiring a moderate amount of personal space and the Anglo Saxon-Eastern European(II) having an aversion to physical contact and requiring the most amount of personal space. Increasing the number of nationalities and establishing other important factors dealing with individual characteristics in future investigations will lead to a greater understanding of personal space.

512. The Effects of Age, Gender, and Predominant Eye Movement in Hemispheric Specialization. JACKIE MACOMB (Alice Robertson Junior High School).

Eye movements were studied in subjects ranging in age from 3 years to 16 years. Reflective questions were asked to determine predominant eye movement. Questions demanding thought in the following subjects were also administered to determine hemispheric specialization: Math, The Complex Use of Words, Facial Recognition, Emotional Sequential Ordering and the Perception of Significant Order, Naming, Perception of Abstract Patterns, and Spatial functions. Predominant eye movement, age, and gender were compared to hemispheric specialization in the eight functions. My results show that age was not a significant factor in hemispheric specialization. However, gender did appear to be a quite significant factor in hemispheric specialization. I found that predominant lateral eye movement was an influencing factor mainly in the overall category of males.

513. FUEL CELLS: TOMORROW'S ELECTRICITY

GREGORY SMITH FLORIDA JUNIOR ACADEMY OF SCIENCE

In recent years, the level of pollutants in our environment has risen dramatically. Combined with the diminishing supplies of petroleum, a non-petroleum powered, pollution-free electric supply is needed. This researcher submits that a hybrid fuel cell-methane generator system is capable of fulfilling these criteria.

Methane generation is accomplished by the anaerobic fermentation of organic refuse. This reaction, producing carbon dioxide, methane, and a high-quality fertilizer, has few restrictions. The desired temperature is approximately 35 °C, and the ideal pH is 7-8. The fuel cell portion of the hybrid consumes the methane and atmospheric oxygen, while ionizing the fuel and oxidizer at the interface between the catalyst coated electrode and the electrolyte. This ionization supplies the external circuit's current, while the ions combine to form the by-products of the reaction in the electrolyte.

This researcher is investigating the various combinations of catalysts and electrolytes possible for the fuel cell. In this way, the most efficient cell may be determined. The goal of this project is to demonstrate a pollution-free low cost, high efficiency, hybrid system.

514. Microcomputer Controlled Digital Waveform Analyzer.

BRADLEY MARTIN (Northeast High School).

A digital waveform analyzer was designed which utilized a specially designed 8080A microcomputer. The analyzer featured four channels of input with preset trigger levels and 2^8 bit resolution per channel in A/D conversion. Softward was given total control of I/O and operational specifications. A four channel high speed oscilloscope switch was included for monitoring four data channels simultaneously. The design can be manufactured at ten percent present cost for a commercially available unit.

515. WATERHYACINTHS (EICHHORNIA CRASSIPES)... A POSSIBLE METHANE AND FERTILIZER SOURCE

Timothy W. Rudolph, Florida Junior Academy of Sciences.

The waterhyacinth was introduced in the United States in 1884 at a Louisiana flower show. By 1894, the hyacinth was growing in most of the Southeastern states. Today, the hyacinth is literally a pest. Chemical, biological and mechanical eradication of the waterhyacinth has been tried, but only temporary control has been obtained. Chemical control of hyacinths result in the increase of the organic pollution load, a decrease in the dissolved oxygen and recycling of nutrients back into the water.

Researchers have tried to find practical and economical uses of the waterhyacinth. Organic matter when anaerobically decomposed yields methane and biologically inert fertilizer as a by-product. A Lake Washington waterhyacinth mat was harvested and anaerobically decomposed to produce bio-gas and fertilizer in digesters of various design. Nutritional value of anaerobically decomposed waterhyacinths was tested using various ratios of decomposed hyacinths to Brevard sand. A Chemical analysis for Calcium, K, P, N, Mg and solidified salts was run on the sand and fertilizer mixture. Optimum plant growth was obtained with the ratio of 1:6 hyacinth to sand.

It has been found that one dry weight pound of hyacinths can produce 1.2 cubic feet of bio-gas at 23 degrees centigrade. A 30 percent increase in temperature results in a 55 percent increase in gas production up to 36 degrees centigrade which is optimum.

516. The Effect of Ozone on Six Textile Fabrics.

JON O. AUSTIN (Spartanburg High School, Spartanburg, S. C.).

This project was designed to determine any physical and related chemical changes of six textile fabrics--wool, cotton, acetate, polyester, polyester/cotton, and nylon--after exposure to ozone. The best way to determine the effect is to expose the fabric to ozone while controlling all other variables and measure the loss of strength which would show up in actual use as accelerated wear. The chemical changes causing the loss in strength were researched by comparing infrared spectrographs before and after exposure and by using viscosity measurements to determine any change in average molecular weight. The results of the experimentation showed a great loss in tear strength in nylon, a lesser amount in polyester/cotton, and still smaller losses in polyester, cotton, and acetate. Wool did not show any noticeable change in strength.

517. The Theory and Implementation of a Semantic Processor.

GLENN C. POOLE (Annandale High School).

The purpose of this project is to develop a method of identifying the semantic information underlying an English sentence, and implementing this method on a digital computer. The computer program acts as a semantic analyzer, resolving ambiguities in the input sentence, and recognizing synonymous words and phrases through reasoning, applying rules, and questioning the user. Other computer programs may then use the semantic analyzer, interpret the information which the analyzer returns, and take appropriate action. This type of processor would be extremely useful in computer control applications, information storage and retrieval, and ultimately, in interpreting computer programs written in English as opposed to the very specific languages which are now necessary in programming a computer. The method implemented uses a simplified version of the case grammar theory.

518. THE INHIBITION OF CLADOSPORIUM RESINAE IN FUELS AND THE USE OF C. RESINAE AS AN OIL SLICK DEGRADANT

SCOTT DENNINGHOFF FLORIDA JUNIOR ACADEMY OF SCIENCE

The fungus, Cladosporium resinae, is often isolated from contaminated hydrocarbon fuel systems. Since it causes sludge deposits in jet-fuel storage tanks that can affect filter systems of aircraft, there is a need to find an inhibitor which is compatible with jet-fuel. There is also a possible valuable use for this fungus as an inoculum for the biodegradation of oil spills.

Phase I: Flasks were prepared containing 150 ml of sterile salt solution, BHS, pH 5.8, and were inoculated with 1.0 ml of a nutrient free suspension of C. resinae. Controls were prepared with no carbon source added, others were overlaid with 10 ml of sterile kerosene, and experimentals had both the kerosene overlaid, and 0.1 ml of an "inhibitor" added. Ether, acetone and ethanol were tested as inhibitors. Results show that C. resinae can use kerosene as its sole carbon source, since the controls showed no growth, and there was definite growth in all flasks containing kerosene. Acetone seems, from this experimentation, to be the best inhibitor.

Phase II: This part of the project examines substances which provide the necessary non-carbon nutrients and a mechanical means of keeping these nutrients and the organism C. resinae in an oil spill. The experimentation shows that, in a wave tank with simulated ocean conditions, and with a paraffinized urea agent and fertilizer, the biodegradation of crude oil is enhanced by C. resinae.

519. Man vs. Ozone: Battle of the Decade.

DON HERMAN (Wamego High School).

Problem: The purpose of this project was two-fold. One: to find the effects of ozone on man and his environment, and two: to find the effects man can have on ozone.

Methods: Ozone was measured using potassium iodide, starch, sodium thiosulfate and iodometric titration. Ozone was generated by electric current and ultraviolet light. Various chambers were used including 5 and 10 gallon aquariums and 1-quart canning jars.

Results: Using Sigmoid Growth curves it was found ozone has an effect on the growth rate of plants. Ozone can fade and deteriorate fabrics. It also causes rubber to lose its elasticity.

Ozone deteriorates quickly. A significant amount will decompose in 10 minutes.

Present Freon 12 concentrations can decompose significant amounts of ozone after 5 minutes. SO_2 can decompose ozone.

Compared to methane and hydrogen peroxide, ozone is a much faster sink for chlorine.

Conclusions: Ozone as a pollutant can be very harmful. It can destroy plants, rubber materials and fibers. As a guardian, ozone is very useful. Through this research it was found that flourocarbons can have a deteriorating effect on the layer, resulting in unknown environmental effects.

"Stratospheric sink for chlorofluoromethanes: chlorine atom catalysed destruction of ozone" Nature, vol. 249, Je 28 1974 Mario J. Molina and F.S. Rowland.

520-531 AM. JR. ACADEMY OF SCIENCES (BIOMEDICAL) THU., 16 FEB., 3 P.M./ SP ADAMS

520. Phenology of the Scilla Siberica. BRIAN D. HUDELSON (James Madison Memorial High School).

A series of phenology studies were conducted in an attempt to determine the conditions necessary for the breaking of dormancy of Scilla siberica. Using 1967 as a base year, information on the blooming dates of Scilla, obtained from the Wisconsin Phenological Society, was compared with weather data, obtained from the U. S. Weather Bureau. Certain temperature conditions were found which correlated with Scilla blooming dates around the state.

Deviations were found in the data. To explain these deviations a computer program was created, which produced a map of Wisconsin and placed blooming dates at points on the map corresponding to observation points. A systematic interpolation routine was then applied and a contour-type map was produced, showing the progression of Scilla as it bloomed in the state. This map was compared to topographic maps and explanations for these deviations were obtained. To confirm the results obtained in the previous research, Scilla bulbs were subjected to a variety of temperatures in laboratory conditions. These laboratory results were then compared with natural observations and correlations were made.

520A Mechanics of Insect Flight. Patty M. Sandborn (Fort Collins High School).

A study of wing structure related to insect flight was undertaken. Measurements of wing shape, size, motion and speed were taken. Aspect ratio (the comparison of wing length to width) and moment of inertia (the measure of area distribution from the wing joint) are two typical properties of wing size and shape. Aspect ratio varied slightly with weight. Moment of inertia increases with length and area. These characteristics did not depend on the type of insect. Wing beat frequency was found to be related to moment of inertia. Thus, size of the insect's wings determine the beat frequency. Wing loading, insect weight divided by wing area, shows that the larger the wings in compairson to weight, the more efficient the insect flies. Wing loading depends on the type of insect.

Although insect wings appear flat, microscopic examination of cross-sections show that they are irregular. Aluminum powder on water made it possible to observe the flow around two dimensional model insect wings. A new theory of insect flight proposed by Weis Fogh explains why some insects can generate more lift than normally expected. This "clap-fling" motion was also modeled and observed.

521. An Investigation into the Growth of Chlorella. MARTIN E. HUBER (Rolling Meadows High School).

The purpose of this investigation is to determine the optimum pH value for Chlorella growth and to determine an estimate of the amount of Chlorella which could be produced on a commercial scale. Cultures of Chlorella vulgaris were grown in a variety of pH values from pH 5.6 to pH 8.0 at gradients of 0.4. The growth was measured with a spectrophotometer, in units of optical density (O.D.), over a period of four weeks. These results were plotted on a line graph as O.D. as a function of time. New cultures were prepared using the optimum pH value for Chlorella growth. The dry mass of 25 ml of the cultures was measured at various time intervals with Millipore filters over a two-month period. These results were plotted on a line graph as mass as a function of time. It was found that the maximum amount of growth occurred at pH 8.0. The maximum amount of growth which could be obtained from 25 ml of solution per day was found to be .267 mg. Extrapolated to a volume of one hectare by one meter, this figure was estimated to become 107 kg per day. Commercial pilot plants can produce 140 kg per hectare per day. However, the depth of the solution is unknown. If the cultures were terminated at an earlier date, the average growth would have increased. The optimum run length is about 21 days, at which time the amount of Chlorella grown is 160 kg per hectare-meter per day.

522. STEREOLOGY: A QUANTITATION OF INTESTINAL SURFACE AREA. JAMES PHILLIP HENEGHAN (BENJAMIN FRANKLIN SENIOR HIGH SCHOOL).

STEREOLOGY IS THE STUDY OF THE THREE DIMENSIONAL STRUCTURE OF MATTER BY ANALYZING TWO DIMENSIONAL SECTIONS THROUGH THE MATERIAL. IN THE PRESENT STUDY, THE SURFACE AREAS OF THE SMALL INTESTINE, THE MOST IMPORTANT SITE FOR NUTRIENT ABSORPTION, AND THE COLON, A SIGNIFICANT SITE OF CANCER DEVELOPMENT, WERE STUDIED. THE IMAGE OF SERIAL HISTOLOGICAL SECTIONS WAS PROJECTED ONTO A GRID AND A COUNT OF THE NUMBER OF TIMES THE INTESTINAL SURFACE INTERSECTED THE GRID WAS RECORDED AND SURFACE AREA CALCULATED. TWENTY RATS, 4 PER GROUP, WERE EUTHANIZED AT 1, 3, 6, 12, AND 18 WEEKS OF AGE AND TWO 1 CM SECTIONS, ONE FOR SURFACE AREA, THE OTHER FOR WEIGHT, WERE TAKEN FROM BOTH THE MID SMALL INTESTINE AND MID COLON. REPETITIVE COUNTS ON THE SAME HISTOLOGICAL SECTION AND SURFACE AREA MEASUREMENTS ON TISSUE SECTIONS FROM THE SAME TISSUE, CUT AND STAINED AT DIFFERENT TIMES, ESTABLISHED THAT STEREOLOGY WAS PRECISE AND REPRODUCIBLE. FROM 1 TO 3 WEEKS OF AGE, THE SURFACE AREA OF THE COLON INCREASES FASTER THAN THAT OF THE SMALL INTESTINE, HOWEVER, BETWEEN 3 TO 12 WEEKS BOTH INCREASE AT THE SAME SLOWER RATES. A SURFACE AREA OF $3.16\ CM^2/CM$ IN THE MID SMALL INTESTINE COMPARED FAVORABLY WITH THE $3.88\ CM^2/CM$ FOUND IN THE LITERATURE. SURFACE AREA COULD NOT BE CORRELATED WITH BODY WEIGHT OR INTESTINAL WET OR DRY WEIGHTS. THEREFORE, FOR ACCURATE MEASUREMENT OF INTESTINAL TRANSPORT, A PRECISE STEREOLOGICAL ANALYSIS OF SURFACE AREA IS NECESSARY. SINCE STEREOLOGY CAN QUANTITATE MANY OTHER IMPORTANT STRUCTURES, STEREOLOGY WILL MAKE SIGNIFICANT CONTRIBUTIONS TO BIO-MEDICAL RESEARCH.

523.

CHANGES IN MITOCHONDRIAL PROTEINS DURING CELLULAR AGING IN DROSOPHILA MELANOGASTER. Jeffrey C. Webster. **Florida J. Academy of Sciences.**

Mitochondria of aging Drosophila melanogaster have been reported to lose their ability to form adenosine triphosphate. In order to gain information on the basis for this important change in cellular metabolism, age-related alterations in mitochondrial phospholipids have been studied by thin-layer chromatography, and in mitochondrial proteins by polyacrylamide gel electrophoresis. No age-related changes in mitochondrial phospholipids were noted, except the appearance of a small amount of a fluorescent substance, which may be related to the classical age pigment, lipofuscin.

Mitochondria of young and old cells were fractionated into outer membranes, the four multi-enzyme respiratory complexes of the inner membranes, and the proteins of the non-membrane matrix. The individual proteins of each fraction were then separated by SDS-polyacrylamide gel electrophoresis. Although aging did not result in measurable changes in most of the mitochondrial proteins, distinct changes in electrophoretic migration were observed in certain proteins of the outer membranes, the matrix, and of two of the four complexes of the inner membrane. Aging appears, therefore, to cause very selective changes in the proteins of mitochondria. The nature of these changes, and how they relate to the loss of mitochondrial function, must still be determined.

524. POLLUTION BY LEAD

ANNE BRASSELLE LOUISIANA JUNIOR ACADEMY

Individual greenhouses were devised to allow for the control of air around experimental plants. Air samples of heavy metal release, lead in this case, were measured. A major characteristic of the greenhouses (being larger and more defined than previous tested models) greatly aided in the accuracy of experimentation. These greenhouses allowed for easy watering and air sampling through such implements as an adaptor for air filters and air flow tubes.

The experiment began with a test measuring the release of lead over a seven day period using the ring oven technique - a method of spot test analysis. Each day for a week the experimental plants were given .2 g of Pb II ions. The results indicated a release of .65 m/g of lead during the test period.

Another test was run to see if transpiration was related to lead release. Plants were given high concentrations of lead at the beginning and then air sampled and tested at the end of each of four six-hour time intervals. The greatest amount of lead was given off between the hours of 12 noon and 6 p.m. An assumption is made that more lead is given off when the plant is undergoing heavy transpiration and photosynthesis.

525. The Significance of the Dimorphic Markings in Australian Zebra Finches With Respect to Male Interaction and Territorial Defense. GREGG TERRELL (Arlington High School).

Abstract. The significance of each dimorphic marking was studied and ranked accordingly with respect to male interaction and territorial defense. Four life-sized models were constructed. The Phase 1 model possessed all markings while Phase 2,3, and 4 models had one different dimorphic marking ommitted. A control phase using a live bird was observed to confirm the model's effectiveness. Observation periods were 10 minutes in length. Data was recorded quantitatively over a period of 4 months. Number of occurrence charts were analyzed using Chi-Square tests. By comparing each varied phase to Phase 1, the significance level of each phase was determined and ranked as follows: from most to least significant, Phase 3 (flanks omitted, $p < .001$); Phase 2 (patches omitted, $p = .04$); Phase 4 (bar omitted, $p = .20$). The white-speckled brown lateral flanks are of greatest importance in releasing agonistic behavior in male-male encounters. Second in releasing power are the orange patches on the side of the head, and third is the black upper chest bar. The white ventral surface, although not exclusively male, may be of some importance as it serves to enhance the other markings, especially the adjacent flanks. It is selectively advantageous to the animal to possess the ability to control and manipulate parts of the body where releasers are present.

526. Mathematical Relationships of Growth Whorls of Selected Gastropods. Susan O. Hinton (Manor High School; Portsmouth, VA).

The purpose of this study was to analyze mathematical relationships of volumetric increase in the growth whorls of selected gastropods. Cross-sections of selected gastropods were obtained, four whorl-sections of each specimen were filled with clay. The clay was removed and weighed with three separate trials. The mean weight relationship was used as an indirect volume comparison from the formula, $D = M/V$, where density was constant for the clay, and the mass was directly proportional to the volume. Arithmetic combinations of volume and mass differences, ratios, and logarithms of these volumes were compared, graphed, and data analyzed for mathematical relationships which could best express the spiral growth conformation. Graphing the results demonstrated that the volume of the whorl-section of selected gastropods was best expressed as a logarithmic function of the mean clay mass required to fill the successive whorl-sections. No simple linear proportionality constants were found to express either the growth relationships between whorl-sections of the same or of different species. The slope of the line formed from the plot of the growth spiral using whorl-section clay masses corresponded with the slope formed by a line drawn tangent to the outer edge of the whorl-sections of the shell. Slopes of the lines formed from the logarithmic plots of the growth spirals using whorl-section masses were different for different species.

527. Life Printing: A New Technique for Biological Studies. LISBETH R. GIBSON (Wills High School, Smyrna, Ga.)

A photographic technique called Life Printing has been developed for the study of leaf structure and disease. The technique, similar to X-ray photography, involves passing ordinary light through the translucent material of the leaf to expose a photographic plate. The first experiment used a contact print method in which a leaf is placed directly on a photographic plate and exposed to light. Because of the desire for more detailed prints, three other methods were developed, the most useful of which is a direct negative method in which a flattened leaf is placed in the negative carrier of a photographic enlarger. By raising the enlarger head, the resulting image can be magnified to any desired size. Prints can be made for each part of the leaf. These prints can be put together to form a mosaic leaf map which shows clearly structural detail and normal and diseased areas, even before signs of disease appear to the eye on the leaf. It is concluded that Life Printing is a potentially valuable technique for the detection and possible diagnosis of plant disease. The prints form a permanent record of the physical state of the leaf and may be compared to future prints to aid in diagnosis and documentation of plant disease or environmental changes. Life Printing should also prove useful as a teaching aid.

528. A Study of Vitamin B_{12} Factor in Eutrophication Using *Euglena gracilis* and *Anacharis*. WILLIAM FAQUIN (Waterloo Community Schools).

The objective is to study the influence of Vitamin B_{12}, Cobalamin, in the process of eutrophication by investigating its effects on the growth of *Euglena gracilis* and *Anacharis*. This study is a result of experiments performed with Vitamin B_{12} content in a body of water relative to quantity of living matter. In order to find the concentration of Vitamin B_{12} producing optimum growth in *Euglena gracilis* and *Anacharis*, these organisms were introduced into several series of Vitamin B_{12} dilutions ranging from $9 \times 10^{-3}\%$ to $1 \times 10^{-3}\%$ for *Euglena gracilis*, and from $5 \times 10^{-3}\%$ to $1 \times 10^{-3}\%$ for *Anacharis*. Dilutions of a commercial 7%7%7% fertilizer were prepared for *Euglena gracilis* and *Anacharis*; optimum percentages of Vitamin B_{12} for these organisms were introduced into a duplicate range of fertilizer dilutions. Results for *Euglena gracilis* and *Anacharis* indicate a concentration of $1.35 \times 10^{-3}\%$ and $2.60 \times 10^{-3}\%$ Vitamin B_{12} produces a climax in the cultures' population growth. *Euglena gracilis* and *Anacharis* did not respond to the dilutions of fertilizer, but reached a maximum point in growth with addition of Vitamin B_{12}. From these studies, it appears that *Euglena gracilis* and *Anacharis* are highly sensitive to Vitamin B_{12} in their environment, and therefore it is indicated that Cobalamin is a factor in the organic productivity of a lake.

529. The Effect of pH and lipid Concentration on an in vitro Antibody-Antigen Interaction. LEE FLEISHER (Cheltenham High School)

This investigation was designed to determine how certain variables, encountered in serum in some disease states, may affect a selected immune reaction. The variables were (1) pH and (2) lipid concentration. The system used was rabbit anti-sheep gamma globulin antibody. The immune reaction was measured by the precipitin reaction which measured the ability of antigen to precipitate the antibody. The buffer solution, which contained the antibody and antigen, was varied between pH 7.2 and 7.6. This range was chosen because in any disease state these are the outer limits the antibody may be subjected to. The effect of the concentration of lipids on the immune precipation was tested with lipid-rich and delipidated sheep colostrum. The evidence to date suggests that the presence of lipids and variations in the pH range between 7.2 and 7.6 has little or no effect on the precipitation of rabbit anti-sheep gamma globulin antibody by sheep gamma globulin.

Guidance and materials for this investigation were provided

by Dr. Ralph Heimer and Mr. Mark Frankel of the Department of Biochemistry of the Thomas Jefferson Medical College of Philadelphia, Pennsylvania.

530. Detrimental Effects of Noise DOUG FARRIS

This experiment suggests the relationship in mice between sound stimuli and stresses produced. A sine wave signal at 1000 cps was produced by an audio generator and amplified to levels at 80, 95, and 110 decibels. Three groups of mice were exposed to a constant sound at the intensities mentioned above. Two other groups were exposed to an intermittant and unpatterned sound at intensities of 95 and 110 decibels. And lastly a control group being exposed only to the noise of the area which was measured at approximately 55 decibels. A 30 minute daily exposure to the sounds was employed. Comparison was made with results obtained from these five groups and the control group. It was found that the mice had an increased heart rate, increased food intake, and some indirect responses such as hypertension and aggressiveness. Also an intermittant and unpatterned sound had more harmful effects than the constant sound of the same intensity. The intensity of sound matched the intensity of the responses.

531. A Search For Red Dye #2

Katherine J. Lochhead, Harrison High School, Harrison, Arkansas.

Recently, scientific journals have been giving a great deal of attention to food additives. Since 1971, consumers ate over thirty billion dollars worth of Red Dye #2. Russian and FDA studies indicated that Red Dye #2 does cause cancer, and it was banned in January, 1976. Since then many other synthetic dyes have been questioned. Artifical colors were separated from foods and qualitative tests were done to determine the colors contained in certain foods and cosmetics. Although none of the Red Dye #2 was found, wide usage of other synthetic dyes was in evidence in every product tested.

The general public knows very little about food colors. It comes as a surprise to the housewife to know that the candy which the children eat, the gelatin dessert she used in her salad, the cake she prepared from a cake mix--all contain certified synthetic colors.

There is a complete lack of agreement regarding safe color additives in the markets of the world; the listing of approved colors in any country is often governed, to a great extent, by political pressures and unscientific opinions.

600-623 MATHEMATICAL & PHYSICAL SCIENCES POSTER THU., 16 FEB., 9 A.M./ SP EXHIBIT HALL

600. Implications of the Non-classical Logic of Topoi for Local and Global Existence. DR. CARL S. LEDBETTER, (Wellesley College).

A topos is suitably regarded as a "universe of discourse" for mathematics which generalizes set theory. Lost in the generalization, however, is the validity of certain rules of classical logic, notably the law of the excluded middle, which invalidates certain standard proofs by contradiction in mathematics. The logical rules which do hold generally for topoi are those accepted by the intuitionistic school. The impact of this non-classical logic is investigated in the setting of spatial topoi (sheaves) where topological considerations make it useful to regard the topos as a "generalized space" and in which the intuitionistic rules have implications regarding the local and global existence of continuous sections. The methods presented culminate in the proof of a powerful new general theorem on the representation of algebras with certain primeness conditions by continuous global sections in spatial topoi, which subsumes most classical representation theories.

601. Elimination of Linear Parameters Applied to Dose-Response Relationships of n-Order Kinetics. J. BASULTO; E. RUBIO; E. MORCILLO (Dept. of Pharmacology,School of Medicine. University of Valencia.Spain).

The equation $E_A = E_M/1 + (K_A/[A])^n$ (1) which gives the effect (E_A) of a full agonist (A) as a function of the drug concentration, the drug-receptor dissociation constant (K_A) and the maximal effect (E_M) with a drug-receptor combining ratio of n, is an example of a nonlinear regression function.

The Hill linear transformation of (1) is the usual way to evaluate K_A and n, but it has several disadvantages which include the necessity of estimating an initial value of E_M.

However it has been demonstrated that the application of the modified Gauss-Newton method and the elimination of linear parameters to (1) gives direct estimations and better fittings of n, K_A and E_M. Examples of the application of this method to dose-response curves of $NaNO_2$ and serotonin in several isolated smooth muscle preparations will be presented.

602. Compartmental Models with Multiple Sources of Stochastic Variability: The One-Compartment Case. J. H. MATIS (Texas A&M Univ.), H. D. TOLLEY (Texas A&M Univ.)

Compartmental analysis provides a rich framework for quantitative modeling in the biomedical sciences. Most of the practical applications of the theory have involved deterministic models, however two classes of stochastic models have emerged recently. One class introduces a probabilistic transfer mechanism with a constant rate and the other deterministic transfer mechanism with a random rate. This paper combines both forms of stochastic variability into a single unified model in a one-compartment context. As an illustration, the previous simple deterministic exponential decay model (1) may be generalized to a stochastic death process with a rate constant having a gamma or a rectangular distribution, which yields models (2) and (3) respectively. This paper also derives the variance and the distribution of the counts at any specified time under the new model. Some properties of these new models are examined and the use of the models is illustrated with an application to rumen passage kinetics.

(1) $Y = Ne^{-kt}$ (2) $Y = N[1 + Bt]^{-\alpha}$

(3) $Y = Ne^{-at}[1 - e^{-bt}]/bt.$

603. A Non-Homogeneous Poisson Process Model for Software Errors. AMRIT L. GOEL(Syracuse University)

The problem treated here deals with the development of stochastic models for the error occurrence phenomenon in large, complex software systems. The software errors are normally removed as they occur but the rate of occurrence of these errors is generally a function of time. A number of models have been reported in the literature to predict software reliability which is defined as the probability of an error-free operation over a specified period of time. In this paper we first briefly outline the state-of-the-art of such models. Next, we employ a non-homogeneous Poisson process with a mean value function $m(t)=a(1-\exp(-bt))$ to establish quantitative measures for software systems. Using the maximum likelihood estimates of the parameters from two actual software error data sets, various quantitative measures are developed and discussed. A Bayesian analysis of the problem is also presented.

604. Algorithms for Sorting Tableau Matrices.

DOROTHEA A. KLIP (University of Alabama in Birmingham).*

An efficient algorithm for the sorting of tableau matrices [3] becomes of crucial importance in the case of (multivariate) polynomial multiplication, where exponent comparison is costly. In this paper it is emphasized and empirically verified that algorithms aimed at reducing the asymptotic expressions for the effort involved, like "divide and conquer" and "heap" [2] cannot be effective in a structured situation. An algorithm GEN-MULT for general tableau matrices which naturally divides the matrix in regions of specific ranges of integer size requires 48% less exponent comparisons than SORT-MULT [1] for the random case. Exploitation of the regularity of the polynomial product matrix to full advantage leads to an algorithm SLICE which compares with ALTRAN's best LI-algorithm [2] timewise in a ratio up to 1:3 in extreme cases of polynomial degree and sparsity for the univariate case. Both GEN-MULT and SLICE require linear auxiliary storage.

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2. Johnson, S.C. Sparse Polynomial Arithmetic, Proc. of the Euro SAM Conf., SIGSAM Bull. 8, 3 (Aug. 1974), pp. 63-71.
3. Knuth, D.E. The Art of Computer Programming, Vol. 3, Addison-Wesley, Reading, Mass., 1971.

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605. Indirect Estimation of Distribution Functions

S. V. Dawson (Harvard School of Public Health), J.P. Butler (Harvard School of Public Health), J. Reeds (University of California)

Discrete, noisy data from heterogeneous decaying systems, such as multicomponent exponential data, is "unfolded" to obtain a continuum estimate of the density of non-negative) components of the system. The Tikhonov regularization, or Phillips-Twomey smoothing, method of estimation is extended and its performance greatly improved by use of non-negativity constraints, which make the estimated answer non-linear in the measurements. The positive portion of the answer is a linear combination of the kernel functions that occur in the integral-equation formulation of the problem. In contrast to unconstrained regularization, delta functions can be recovered exactly, as answers, in the limit of zero noise and zero smoothing. Step-like functions result in answers which display Gibbs oscillations. These oscillations are unacceptably large in cases of noisy data and undersmoothing. An optimal estimate of smoothing parameter is offered for the regularization. This value, which strikes a balance between resolution and stability of the answer, is chosen to minimize an estimate of squared error of the answer, and is data dependent. The optimal estimate is found to have the desirable property of tending to smooth somewhat more than would give the exact (unobtainable) minimum possible value of squared error.

606. Mechanisms for Multiphonon Absorption in Solids.

HERBERT B. ROSENSTOCK (Naval Research Laboratory, Washington, DC 20375)

In "ideal" ionic crystals, optical absorption attributable to atomic motion appears at one wavelength only, corresponding to the frequency of one particular vibrational mode, viz, the so-called "Reststrahl" vibration. But weaker absorption at higher frequencies, attributable to several vibrations or phonons is also observed. Two mechanisms have been proposed for producing this multiphonon absorption, anharmonicity (AH) of the potential and a non-linear electric moment (NLM) induced by the ionic displacements.[1] We argue that the two mechanisms are not independent but closely related, being both physically based on charge distortion. We show that presence of a NLM invariably implies existence of AH; conversely, AH implies an NLM whenever extended, rather than only point, charges exist in the lattice. In the standard "Born-Oppenheimer" expansion which makes the initial separation of nuclear and electronic coordinates possible, the Reststrahl absorption appears in zeroth order, AH terms in first and second order, but NLM ones in third order at the earliest.

1. WALLIS, R. F., ed., Lattice Dynamics,(Pergamon, 1965) see SZIGETI, B., p 405: Langer, Maradudin & Wallis, p44.

607. Self-Organizing Phenomena in Plasmas and Fluids: A Fundamental Challenge to Physics.

DR. STEVEN BARDWELL (Fusion Energy Foundation.)

Recent experimental and theoretical research in the regimes of highly nonlinear behavior of fluid and plasma systems has demonstrated the existence of "self-organized", non-entropic behavior in non-biological systems. A review of this research shows that physics as presently understood is inadequate for an understanding of these phenomena. There are three specific areas in which conceptual difficulties arise in attempting to describe self-organizing phenomena. 1) The "thermodynamics" of nonlinear regimes. No H-Theorem can be proved for highly nonlinear systems, and experimental evidence is very strong for the existence of global, non-entropic evolution of physical systems, which have self-concentrating energy fluxes and increasingly complex internal structure. 2) "Stability" and statistical theories of nonlinear phenomena. These most recent attempts to describe phenomena such as turbulence in fluids and plasmas have been shown to fail to explain turbulence. The general conclusion of recent work is that "instability" leads in fact to greater order and structure, and that the Maxwellian "equilibrium" of "linear" systems is "unstable". 3) Continua and field theories. Evidence from the nonlinear phenomena in fluids and plasma points to a non-affine structured universe.

608. Volume Reduction of Plutonium and Americium Contaminated Soil.

ROBERT L. KOCHEN AND JAMES D. NAVRATIL (Rockwell International, Atomics International Division, Rocky Flats Plant).

A primary process has been developed to reduce the volume of Rocky Flats soil contaminated with plutonium and americium. The process consists of attrition scrubbing and wet screening methods which reduce the volume of contaminated soil by approximately 65%. Various reagents have been tested to aid in dispersing and decontaminating the soil. The reagents that improve the process are solutions of oxalic acid and sodium hexametaphosphate. Preliminary studies of secondary treatment methods will also be discussed.

609. Effects of Liquid Crystal Solvents on the Photochemical Dimerization of Acenaphthylene.

JEANNE M. NERBONNE (Georgetown University) and RICHARD G. WEISS (Georgetown University).

We have investigated the role of liquid crystalline solvents on the rate and specificity of photodimerization of acenaphthylene (*A*) to its *syn* and *anti* cyclobutane dimers. These solvents provide a convenient probe into intimate solvent-solute interactions. Quantum yields (Φ) and product distributions of the dimerization in toluene (*T*), *n*-butyl stearate (*S*) and a 50/50 mixture of 5α-cholestan-3β-yl acetate and nonanoate (*C*) have been determined as a function of temperature, solute concentration, percent conversion and solvent phase. The ratios of Φ(*S*)/Φ(*T*) remain near unity from 18-80°C, which includes a smectic phase (18-25°C) of *S*. In the cholesteric phase of *C* (10-45°C), Φ(*C*)/Φ(*T*) at 0.10*M* *A* is 20-25. When 0.02*M* *A* is employed, Φ(*C*)/Φ(*T*) ≈ 75 at 35°C. The magnitude of Φ(*C*) increases linearly with increasing concentration of *A* at 55°. At 35°C, Φ(*C*) *decreases* rapidly from 0.02*M* to 0.10*M* *A* and *increases* from 0.1*M* to 0.5*M* *A*. A scheme to account for these results and data on other systems which have been studied will be presented.

610. The Scarcity of Water on Venus: Possible Implications for the Age of the Solar System. ROBERT W. MEDEIROS (West Chester State College).

The terrestial size and density of Venus, and its proximity to Earth in the Solar System, would lead one to expect that instead of being scarce, water might be relatively abundant on Venus. An explanation for this anomaly sees the planet as once having possessed substantial quantities of water which was vaporized and driven off into space during a period of increased solar luminosity. Most likely this occurred about 4.6 billion years ago. The event caused generally widespread melting and vaporization of material in the inner solar system. The present CO_2 atmosphere of Venus resulted from thermal decomposition of carbonate rocks in the crust. It is suggested that the sun and planets may be older than current estimates, and that isotopic ratios given as evidence for a 4.6 billion year old Solar System actually reflect the time of condensation of materials vaporized by a solar episode.

611. Do Planets Explode? T. C. VAN FLANDERN (U. S. Naval Observatory).

In 1972, M. W. Ovenden presented a dynamical derivation of Bode's law governing the distances of the major planets from the Sun. His calculations demonstrated that the mass of the Planet missing between Mars and Jupiter must have been close to 90 Earth masses (about Saturn's size). Today we find thousands of asteroids there instead, whose aggregate mass is less than 0.001 Earth-mass. An explosive planetary break-up was suggested. The present author has examined the orbits of long-period comets, and finds much evidence that these also originated in a violent break-up event near the asteroid belt, but at an epoch of just five million years ago. This evidence includes a clustering of orbital periods of revolution near five million years, the existence of many comets known to have made only one revolution around the Sun, a bias in the directions from which comets approach the Sun of the type which must occur from an explosion near the Sun, a net angular momentum suggestive of that of a planet, and a statistical tendency for orbits traced back in time for five million years to intersect in a common point. Much physical and chemical evidence from asteroids and meteorites supports the reality of this event. See also the related paper, "The Age of the Asteroid Belt."

612. Mathematical Model of Planetary Distances JOHN A. ANTAL (Rockwell International)

The mathematical model of an ideal satellite system comprised of one primary and a number of orbiting natural satellites is a postulated wave equation with a periodic forcing function. At resonance, the eigen-valued solutions of the radial component of the wave equation yield the product solution

$$R(m,n) = \left(\frac{GMS^2}{4\pi^2}\right)\left(\frac{m\pi}{2}-2\right) \times \left[Ae^{n/\sqrt{2}} + Be^{-n/\sqrt{2}} + C\right]$$

where R(m,n) is the mean separation distance of a satellite, identified by the integer n, from its primary, identified by the satellite system integer m. In the solar system, m is associated with a planet of mass M and spin period S, G is the gravitational constant and A, B and C are system-independent constants. The eigen-valued solutions agree strikingly with the observed values for the sun and planetary systems and imply that the planets (as well as the satellites of the planets) were ejected periodically in serial order from the core of the primary during spin-orbit resonance. Over a time span of billions of years, they drifted outward to their presently observed positions diminishing in turn the spin rates of their respective primaries.

613. Core Studies Applied to Hot Dry Rock Geothermal Energy Extraction. ANDREA EDDY AND A. WILLIAM LAUGHLIN, (Geological Research Group, Los Alamos Scientific Laboratory, Los Alamos NM 87545)

Cores from two holes penetrating 2166 m of Precambrian rock yield geologic information bearing on the feasibility of Hot Dry Rock Geothermal Energy Extraction. Precambrian cores were sampled for petrologic, geochemical and geochronological investigations, physical measurements and fracture studies. Intrusive into a complex gneiss/schist sequence, the geothermal reservoir rock is a physically and chemically homogeneous, essentially impermeable, granodiorite (2591-2928 m). Although closely spaced fractures are common, they are mostly calcite-sealed. Calcite's low shear strength and high solubility facilitate hydrofracturing and chemical leaching for reservoir enhancement. Textural differences (gneissic, schistose, granitoid), mineralogical variations, and degree of alteration affect the speed and direction of drilling and fracturing, and alter reservoir permeability by preferential leaching. Sharp lithologic changes, especially fault contacts, influence acoustic signals in hydrofracture mapping; signals are apparently less affected by subtle physical anisotropies within the gneiss/schist complex above the reservoir. Ubiquitous magnetite allowed paleomagnetic orientation of otherwise unoriented cores but hindered magnetic hole surveys. Thus, measurable geologic parameters affect drilling and fracturing operations and dictate the quality of the geothermal reservoir.

614. Oscillations of the Magnetic Field and Related Changes in Climate. FRANZ G. MAYR (UQAM, Montréal)

The chart describes the first cold phase of the last glaciation. The observed relationships appear, however, to be generally valid and still operating today.

The sediment, a varved clayey silt, was laid down in an ice-dammed lake that existed through more than 10,000 years. The locality (Fritzens, Tyrol, 11°34'10"E, 47°15'33"N, alt. 650m) is situated in the Austrian Alps.

Paleoclimatic interpretation is based upon the varying sedimentation rates of i) fine silt and 'clay'(1-20 microns), ii) medium and coarse silt(20-60 microns), and iii) powdered limestone. The three sedimentation rates differ widely from each other; periodicities are clear-cut and very significant. Major anomalies coincide with oscillations of the magnetic field that swing beyond the usual limits of secular variations.
As of the magnetic field, three basic types of variations were observed: a) right turns, or clockwise circular movements of the compass needle, b) left turns, and c) oscillations along a plane. Every change in the sense of a turn, and every beginning of a new full turn concur with a change in the trend of the sedimentological data. The correlation between the oscillations of the magnetic field and changes in climate was, therefore, positive in 35 cases out of 35.

The mean period of equal trend was 22 years.

615. The Thermodynamic Properties of Realgar* Gerald K. Johnson (Chemical Engineering Division, Argonne National Laboratory), Carl E. Johnson (Chemical Engineering Division, Argonne National Laboratory) *Work performed under the auspices of the U. S. Engergy Research and Development Administration.

The thermodynamic properties of sulfides are of interest in the geothermal energy program because of the environmental and corrosion problems associated with them. We have undertaken a program to determine the thermodynamic properties of a number of sulfides using fluorine bomb calorimetry and drop calorimetry. The thermodynamic properties of realgar, As_4S_4, were studied initially as these properties appeared to be especially discordant in the literature. The enthalpy of formation of a high-purity sample of β-As_4S_4 was determined from measurements of its energy of combustion in fluorine according to the reaction

$$\beta\text{-}As_4S_4(c) + 22F_2(g) = 4AsF_5(g) + 4SF_6(g).$$

Fluorine bomb calorimetry is especially well suited for the study of As_4S_4 as it reacts spontaneously and completely in fluorine to form well-defined gaseous products. The results of the bomb calorimetry establish that the generally accepted value for $\Delta H_f^\circ(As_4S_4)$ is in error by 100%. Drop calorimetric measurements were also performed on the sample to a temperature of 800 K, which is approximately 220 K above the melting point. These measurements yielded enthalpy functions, heat capacities, and entropy data for both solid and liquid As_4S_4.

616. The Non-Glacial Earth: Characteristics of Coastal Regions. RICHARD L. BOWEN (University of Southern Mississippi)

Erosional and depositional processes consequent from the multiple Pleistocene eustatic sea level fluctuations (through ~ 150m vertically) have elongated world coast lines by 1/3 or more relative to their length in pre-glacial portions of the Cenozoic. The littoral zone (broadly defined) is correspondingly increased. What, then, does this signify regarding the nature of coastal regions in non-glacial times? Considering this question suggests the following characteristics of coastal regions in such times:

1. A general lack of estuaries, lagoons, bays, and major coastal indentations and capes except where deltaic and tectonic processes dominate coastal development. Straight or gently curved equilibrium coast lines should, therefore, constitute a much larger portion of the world's coastal zones than at present.
2. A virtual absence of resistate-mineral barrier islands (and the sounds they protect) except in tectonically or deltaically dominated regions.
3. Possibly, both calcarenite barrier islands and bioherm-ally constructed islands would be relatively more significantly dispersed in distribution and effective in controlling coastal processes and development.
4. Sedimentologically and ecologically reducing environments markedly reduced in area and distribution relative to oxidizing environments in the world's coastal regions.

617. A Comparative Hydrogeochemical Investigation of Two Western Coal Regions. JOHN F. BUSBY, G. FEDER, ROGER LEE, L. G. SAINDON.

The objectives of this study were to test for similarities of water chemistry between two coal regions in Wyoming and Montana, to characterize the natural variation in the major inorganic components and physiologically important transition elements, and to deduce those geochemical mechanisms most likely to be controlling the chemical quality. A sampling scheme based on stratified random sampling was used to make a comparison of samples collected and analyzed by the U.S. Geological Survey. The data were compared using an analysis of variance model.

$$\text{Log } X_{ijkl} = N + R_i + T_{ij} + S_{ijk} + E_{ijkl}$$

The conclusions of the study were,

1. The differences in water chemistry in the two coal regions are not statistically significant with regard to major inorganic ions and selected trace elements; therefore, concepts and conclusions valid in one region should have transfer value to the other.
2. Cation exchange and sulfate reduction appear to be the major geochemical processes controlling the variation of the selected transition elements of interest and the major inorganic components as the water moves from recharge to discharge areas.

1/ U.S. Geological Survey, Cheyenne, WY; Lakewood, CO; Billings, MT; Lakewood, CO.

618. The Importance of Geosciences in Developing In Situ Technologies for Energy Resource Recovery. L. L. SCHWARTZ, D. O. EMERSON, J. D. TEWHEY, W. J. BEIRIGER (University of California, Lawrence Livermore Laboratory, Livermore, CA 94550).*

Technologies for energy resource recovery through modifying or processing the resource in situ are receiving renewed emphasis as a result of improved economics for recovery of low-grade, deeper, or more difficult-to-recover resources. In addition, there are perceived environmental advantages for in situ processing over some conventional methods. Because the major processing activities (fracturing, fluid flow, heating or chemical modification) take place in the formation at depth, the geosciences play an important role in developing these technologies and assessing their environmental impacts. Some of the geoscience topics of major concern are 1) the mechanical response of formation rocks to explosive or hydraulic fracturing; 2) geochemistry relevant to chemical processing and environmental effects; 3) geotechnical considerations for underground and surface stability; and 4) geological and hydrological criteria and assessment for site suitability. On-going studies dealing with these are presented for in situ technologies in coal gasification, oil shale, and gas stimulation.

619. New Equal-Area World Map Projections and Base Maps. F. WEBSTER McBRYDE (McBryde Center for Human Ecology, Potomac, Md.; Transemantics, Inc., Washington, D.C.).

These composite world maps combine advantages of two types of equal-area projections: 1)fusiform ovaloidal, with polar points, straight parallels and curved meridians (quartic, parabolic, and sinusoidal), and 2) "flat-polar" derivatives of these three (McBryde-Thomas* Projections Nos. 4, 5, and 3, respectively) juxtaposed for high latitudes. Useful properties include: a) total world scope; b) area size comparability (all surface features in true areal proportions); c) latitude comparability along straight, horizontal parallels, spaced at true (or nearly true) intervals for most of the habitable earth (55°N. to 55°S. Latitude); d) true scale (or nearly true) horizontally on parallels and vertically on meridians, in areas of c); e) true directions east-west along parallels and north-south on mid-meridians; f) true shapes of continents near mid-meridians, with minimized distortions on sectional maps; g) adequate plotting space in high latitudes; h) "polar-line" extensions for lateral continuity of plottings. The purpose of these projections is to improve 1) visual impressions of earth features, 2) bases for thematic world maps.

*Equal-Area Projections for World Statistical Maps. F. WEBSTER McBRYDE and PAUL D. THOMAS. U. S. Department of Commerce, Coast and Geodetic Survey. Special Publication No. 245. Washington, D.C. 1949.

620. Climatic Sensitivity in $^{13}C/^{12}C$ Values in Tree Rings from Chaco Canyon. TERRY MAZANY, JUAN CARLOS LERMAN, and AUSTIN LONG (Isotope Geochemistry Lab, University of Arizona).

Stable isotope research has suggested that there is a possible relationship between stable carbon isotope ratios (in the form of $^{13}C/^{12}C$) and climate. To investigate this relationship and contribute to the archaeologist's understanding of local climatic conditions, a dendrochronologically dated tree-ring sample (*P. ponderosa*) from an archaeological site in Chaco Canyon, New Mexico was analyzed for stable carbon isotopes. Lignin and cellulose from the whole wood were analyzed separately in a series of twenty-two 10-year samples and one 6-year sample spanning more than two centuries (AD 820-1045). The measured isotope values of both lignin and cellulose, when plotted against the regional tree-ring width chronology (which provides a generalized record of moisture and temperature), showed highly significant inverse correlations. This is evidence that variations in the $^{13}C/^{12}C$ ratios are related to fluctuations in rainfall and temperature. When exact mechanisms are understood, even more detailed paleoclimate data can be recovered by stable carbon isotope analysis.

621. Computer Simulation of Interaction of Biosphere and Atmosphere. E. LERNER (Fusion Energy Foundation).

Previous attempts to devise computer simulations of the global weather system have neglected two outstanding features of meterological phenomena--the strong effect of the biosphere on the atmosphere, and the dominance of large-scale vortices. The present model takes into account the mutual impact of biospheric moisture throughput and atmospheric rainfall and the interaction of the large-scale cyclones and anti-cyclones with these energy flows. Such energy flows set up strongly nonlinear and self-structuring phenomena in the atmosphere. Using this model we have studied the stability of the global weather system, applicability of the model to intermediate-term weather prediction, and theoretical features of vortex dynamics. The hypothesized biospheric-atmospheric interactions also have profound implications for very long-term climatological, biological, and geological evolution, and some of these implications are indicated.

622. Solar Radiation Data Deficiencies and Their Implications for Solar Energy Analysis. ARNOLD D. NADLER (Arnold D. Nadler Associates, Rutgers University and the New School for Social Research).

Almost all of the U.S. National Climatic Center solar data base is for total radiation on a horizontal surface (TH). Because the TH is often substantially less than the direct normal to the receiving surface (DN), published data can be misleading. This is especially true in northern latitudes during the winter. DN variations, both as a function of season and of latitude, are much smaller than TH variations. e.g. An estimated Jan. vs. July DN ratio in Caribou, Maine is 0.64 compared with a TH ratio of 0.26. The January Caribou vs. Miami, Florida DN and TH ratios are 0.76 and 0.38 respectively. Thus the DN data reveal a significantly higher winter solar potential for Caribou than do the TH. Theoretical computations of maximum solar flux, from direct plus scattered sunlight, confirm the above. Data are in kw.-hrs./meter^2/day.

	Winter Solstice		Summer Solstice	
	45°N	30°N	45°N	30°N
Normal	5.1	6.9	12.9	11.9
Horizontal	1.6	3.4	8.6	8.8

In 1976, DN recording stations in the continental U.S. numbered only four, two of which were partially out of service. In addition, some existing long term TH data are suspect. e.g. Blue Hill, MA reports 16% fewer hours of sunshine, but 19% more TH in January than nearby Boston.

623. Atmospheric Dust Near Cape Blanc, N.W. Africa. FREDERICK K. LEPPLE (Naval Research Laboratory, Washington, D.C.), KARL-HEINZ SZEKIELDA (Gesellschaft Kernenergie Verwertung, Geesthacht, F.R. Germany).

The concentration of airborne particulate matter (soil dust) was measured near ground level at Nouadhibou (NDB), Mauritania from March to June, 1974. Data from two sampling stations 5km apart operating simultaneously showed significantly different dust concentrations due to micrometeorological effects. In March, the seaside station dust concentrations ranged from 100 to 5137 $\mu g/m^3$ (time weighted avg. $\bar{x} = 513$ $\mu g/m^3$) while the corresponding airport station data ranged from 33 to 13421 $\mu g/m^3$ ($\bar{x} = 1634$). Subsequent ranges of dust concentrations and averages for the airport station were: 12 to 3469, $\bar{x} = 360$ $\mu g/m^3$ (April): 76 to 2522, $\bar{x} = 817$ $\mu g/m^3$ (May) and 107 to 1207, $\bar{x} = 400$ $\mu g/m^3$ (June). Monthly mass transport of dust per km of coastline near NDB has been calculated from this data, NDB Airport meteorological information and observations on the height and extent of the dust layer. The transport of dust near Cape Blanc was projected to be 32×10^6 metric tons/yr. The mass median diameter of the NDB dust was 58 ± 5 μm. From Stokes' Law considerations approximately 90% of the dust mass should deposit in the N. Atlantic within 250 km of the coastline. Mineralogical and chemical analyses of several NDB dust samples are also presented and compared to African dust collected over the N. Atlantic Ocean 1500 km NW of NDB.

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624.
Analysis of the Dose-Response Curves of Sodium Nitrite in Several Isolated Smooth Muscle Preparations. E. MORCILLO (Johns Hopkins Medical Institutions, Baltimore, Maryland 21205).

The dose-response curve (DRC) for the myorelaxant properties of $NaNO_2$ was studied in several isolated smooth muscle preparations, previously contracted submaximally with different agonists: KCl, serotonin,acetylcholine and oxytocin in rat uterus KCl and acetylcholine in rat duodenum;histamine in guinea-pig ileum and noradrenaline in rat vas deferens after a plateau level of muscle tone was achieved,cumulative dose-response curves for $NaNO_2$ (3.4×10^{-3} to 0.87M)were obtained by geometric increase(x2)in concentration until a maximal response(E_M) was reached. Eight complete DRC's obtained for each agonist on each muscle preparation. Affinity($1/K_A$),slope(S) and E_M were calculated from linear regression analysis (least square method)on the $[A]/E_A$ vs. $[A]$plot. When experimental DRC's were compared to DRC's constructed from theoretical K_A,S and E_M, a leftward shift was observed,indicating a drug-receptor combining ratio (DRCR) greater than 1. Recalculations from a Hill plot gave theoretical values in good agreement with those observed experimentally. DRCR was calculated to be approximately 2 suggesting that 2 molecules of $NaNO_2$ interact with each receptor site in producing its myorelaxant action.

625. Radiochemical Assays For N-Acetyl-Aspartate Amidohydrolase And Its Occurance In The Tissues Of The Chicken. Elon Wertman, Faye Foster, Robert Thomas, Euritta Danglar and Amedeo F. D'Adamo, Jr. (York College, Queens, N.Y. 11451)

N-Acetyl-L-aspartic acid (NAA) is found in high concentrations only in the nervous system of the higher vertebrates where one fourth is localized in the synaptosomes. Simple and rapid radiochemical assay methods for the determination of NAA amidohydrolase activity have been developed. In non-nervous tissues of the adult chicken activities varied from high levels in the kidney to low levels in heart and breast muscle. Treatment with a detergent significantly increased the enzyme activity, suggesting that a portion of the enzyme is membrane bound. No activity of the enzyme could be detected in the brains of chick embryos prior to 14 days of gestation; activities increased sharply during the 'critical period' of brain development. This developmental pattern of NAA amidohydrolase activity is similar to that for other enzymes, such as glutamic decarboxylase, involved in neurotransmitter systems. The data suggest that one role of NAA may be to act as a storage form for transmitter aspartic acid. Supported by U.S.P.H.S. Grant SSO6RR08153.

626. Structure of Hyphal Wall Peptides from Neurospora Crassa. C. Richard Wrathall (American University)

The hyphal wall peptide of Neurospora crassa forms, through covalent, alkali labile linkages to the β-1,3 glucan, a high molecular weight reticulum within the wall. The structure of this peptide, as well as the way it is incorporated into the wall, is of great interest. All colonial strains tested showed reduced quantities of peptide in their walls, but only the mutant doily has been found to have an abberant peptide. This differs from the wild type peptide in several respects: (1) the molecular weight of doily peptides is lower than that of the wild type, which is about 3800 daltons, (2) the doily peptide does not bind to DEAE at pH 7.4, as does the wild type, (3) acid hydrolysis shows the doily peptide to be almost completely lacking in acidic (glutamic and aspartic) residues, whereas these two amino acids are the predominant ones in the wild type peptide, and (4) although mannose and galactose are found in the wild type peptide, significantly more are found in the doily peptide. It is felt that a simple explanation for the loss of acidic residues in the mutant doily is that there is a defect in the formation of an alkali-stable linkage which joins a block of acidics to the rest of the peptide. This linkage may involve either mannose or galactose, or both, and must be of an unusual type. Thus this mutant, doily, can be used

as a model system to study the insertion of peptides into the hyphal wall, as well as the nature of glycopeptide linkages in general.

627. Chemistry and Biosynthesis of Surface Polymers Containing Poly Sialic Acid in Escherichia Coli K-235. THOMAS E. ROHR, NIH-NIAMDD Bldg. 4, Rm 327, Bethesda, MD. 20014 and FREDERIC A. TROY, Dept. of Biological Chemistry, University of California School of Medicine, Davis, CA 95616.

Membrane preparations from E. coli K-235 contain a sialyltransferase which incorporates NeuNAc from CMP-NeuNAc into a membrane-bound sialyl polymer. Periodate oxidation followed by borohydride reduction of poly [14C]NeuNAc synthesized in vitro converts the non-reducing terminal [14C]NeuNAc into a seven carbon analog, [14C]NeuNAc-7. The ratio of [14C]NeuNAc to [14C]NeuNAc-7 residues released by neuraminidase digestion of the oxidized polymer gives a direct measure of the average chain length. This ratio increases to about 50 NeuNAc residues per chain during the first hour of synthesis, then remains relatively constant for at least the next eight hours during which time polymer synthesis continues at a constant rate. Native sialic acid polymers were isolated from generally [14C]-labeled membrane preparations. The isolated sialyl polymers were found to be 95% sialic acid, with an average chain length of over 200 residues. The remaining neuraminidase resistant portion of the polymer, presumably representing the sialyl polymer-membrane linkage region, was a single highly anionic species of large molecular weight.

628. The Effect of Chemical Treatment on the Electrophoretic Pattern of Cells from Xenopus laevis. JAMES R. GERDY (Denison University).

Studies of changing patterns of cell electrophoretic mobilities in Xenopus were undertaken. The data was obtained by the use of a commercially manufactured cytopherometer but with an improved electrode system. The effects of certain chemicals were tested in an attempt to determine something about the nature of the charge carriers on the surface of the cells. Treatment of the cells with either neuraminidase or trypsin resulted in an almost (neuraminidase) or completely total (trypsin) loss of electrophoretic mobility. When crude histone is added to a suspension of selected cells branched chains of cells are formed spontaneously, and these stranded arrangements usually were composed of chains with two to twenty cells.

629. **Aryl Acylamidase: An Enzymatic Marker for the Outer Membrane of Chicken Kidney Mitochondria. JOHN J. GAYNOR (Waksman Institute of Microbiology, Rutgers Univ., New Brunswick, NJ 08903), CECIL C. STILL (Department of Biochemistry & Microbiology, Rutgers Univ., New Brunswick, NJ 08903).**

Aryl acylamidase (aryl-acylamide amidohydrolase, EC 3.5.1.13) was localized on the outer membrane of chicken kidney mitochondria. Mitochondria were prepared by isopycnic centrifugation on gradients of the silica sol Ludox AM, and were shown to be substantially free of both lysosomal and microsomal contamination. Subfractionation of the gradient-purified mitochondria indicates that the enzyme is located on the outer membrane and is suitable for use as a marker enzyme. Enzymatic activity was measured by following the release of 3,4-dichloroaniline from the substrate 3,4-dichloropropionaniline (Propanil, Monsanto Co.). The highest specific activity was always associated with the outer mitochondrial membrane (ca. 300 μg 3,4-dichloroaniline released·mg protein^{-1}·hr^{-1}) but could be released from the membrane by sonication. Preliminary results indicate that this enzyme is present in substantial amounts only in chicken kidney preparations and may thus provide a basis for the differentiation of distinct mitochondrial classes. A natural substrate and physiological function for this enzyme have not yet been identified.

630. Retardation of Tumor Growth in Tumor Bearing Mice by RNA from Tumor Immunized Guinea Pigs. VINAY LIKHITE (New York University).

A/J mouse sarcoma 1 (Sal) tumor immunized Moen-Chase guinea pigs showed delayed skin reactions to Sal cells on intradermal challenge; and their peritoneal cells were specifically inhibited from migrating in vitro by Sal cells. RNA, extracted by the 'hot & cold' phenol method (Science 175:204,1972),was injected intraperitoneally weekly into A/J mice given Sal tumors subcutaneously 5 days previously. Mice receiving no RNA,or normal RNA,died in 25 to 30 days. In contrast, mice receiving RNA from Sal immunized donors died in 42 to 78 days and their tumors grew slowly. Attempts to identify the RNA-associated 'transfer' factor or factors are in progress. (Supported by P.H.S. Rexearch Grant # CA 17104 from the N.C.I.).

631. Inhibitory Effect on Protein Synthesis of Low-Molecular-Weight RNA from Nuclear Ribonucleoprotein Particles of Adenovirus-Infected HeLa Cells. M. H. SARMA and N. K. CHATTERJEE (New York State Department of Health, Division of Laboratories and Research, Albany, NY 12201)

A group of low-molecular-weight RNA molecules (75-168 nucleotides) isolated from nuclear ribonucleoprotein particles of adenovirus-infected HeLa cells inhibited cell-free protein synthesis directed by exogenous mRNA. The mechanism of inhibition was studied in partial reactions of peptide chain initiation using purified 40S and 60S ribosomal subunits and pH 5 enzyme from ascites cells, polyribosomal RNA, partially purified initiation factors from reticulocytes, and [^{35}S]Methionine. Inhibitory RNA did not inhibit the binding of [^{35}S]Met-tRNA$_f$ to 40S subunit. Complete reconstitution of the translational system transferred 50% of the [^{35}S]Met-tRNA$_f$, (half 40S, half 80S) from the free to the bound form in 20 min at 37°. In the presence of the inhibitory RNA, radioactivity in the 80S region was negligible (∼7%) compared to the 40S region. These results suggest that the inhibitory RNA prevents 40S-mRNA complex from entering into 80S initiation complex with 60S subunit. Direct binding assays using authentic initiation factors IFM2A and IFM2B for the subunit joining reaction (FEBS Letters 76:1, 1977) indicated that the inhibitory RNA binds specifically with IFM2B and competes with mRNA for binding site(s) on IFM2B. (Supported by NCI Grant R01 CA19707-02).

632. **The Additive Effects of Two Mutant Genes on Otolith Formation in Mice T.M. RAUCH (Cincinnati Technical College)**

There are several genetic loci in mice causing otolith defects within the inner ear. The pallid gene (pa), has been shown to affect the deposition of crystals by interfering with manganese metabolism. Another mutant, tilted head (th), is linked to the pigment gene leaden (ln), and causes reduced otoconia distinct from pa. In this experiment, mice were produced with both otolith mutations, to determine their additive effects on otolith formation. The resultant progeny (pa/pa; ln th/ln th) revealed a more severe otolith defect than either pa or th alone. Cleared otic capsules showed a complete absence of crystals in both the utricle and saccule, in all but two animals.

633. Possible Mechanism of Interspecies Transfer of Genetic Information Via Xenotropic Viruses. G. A. HEGAMYER, J. E. STRICKLAND, P. T. ALLEN, AND A. HELLMAN (National Cancer Institute, Frederick Cancer Research Center, Frederick, Maryland 21701).

M55 virus, a xenotropic virus isolated from normal adult NIH Swiss mice by direct inoculation of mink target cells with cell-free uterine extracts, contains a 10-12 S DNA which was not lost when the virions were treated with deoxyribonuclease. This DNA appears to be double-stranded with single-strand nicks and serves as an effective template-primer for reverse transcriptase. A complementary DNA synthesized from the viral DNA annealed to DNA from M55 virus-infected mink cells but not to NIH mouse DNA. Hybridization data indicate that the viral DNA consists of unique rather than repetitive sequences. Therefore, it is unlikely that the viral DNA is a random selection from the cellular DNA pool. Unique DNA sequences are thought to represent, at least in part, structural genes. Since the viral DNA serves as a template-primer for reverse transcriptase and since xenotropic viruses have a broad host range, it is possible that interspecies transfer of genetic information may occur via xenotropic virus infection. The evolutionary implications are obvious, but experimental verification will be problematical since such a mechanism must necessarily operate at an extremely low efficiency.

634. Comments on a Non-Darwinian Model of Evolution. DR. R. POLLAK (Fusion Energy Foundation).

All biology rests upon the foundation of neo-Darwinian evolutionary theory. Experimental evidence is presented which contradicts the prevelant Darwinian-Mendelian viewpoint, and coheres with an hypothesis of an expanding, self-developing biosphere. The implication of this and other data further call into question the present view of DNA as an inert molecule whose evolutionary contribution is determined by a passive alteration of its characteristics by random mutations, etc. Experiments involving flax were specifically addressed to the question of whether it is possible for particular environmental stimuli to induce changes in an organism which are heritable. These experiments by Durrant have irrefutably demonstrated that specific sets of conditions can bring about a change in the energy-throughput capabilities of an affected organism, and that even in the later absence of these special conditions the change proves heritable. Further experiments have demonstrated that specific, substantial changes in the DNA content per cell are associated with these environmental conditions, and that these DNA changes apparently have a mediating, albeit transient, role in the generation of the new genotypes. These DNA changes suggest a new understanting of fundamental aspects of molecular genetics.

635. The Contribution of Histone H1 to Chromatin Structure. JIM GAUBATZ, KATHY HUBER and ROGER CHALKLEY (University of Iowa, Iowa City, Iowa 52242).

Chromatin in intact nuclei was sheared by micrococcal nuclease to produce a dispersed mixture of nucleosomal repeats (~ 10% chromatin digested). The involvement of histone H1 in the structure of chromatin was assessed by correlating sedimentation coefficients and DNA chain lengths of nucleosomes with the presence or absence of H1, as well as the structural integrity of H1. These studies were performed as a functon of the cation concentration as we attempted to mimic more accurately the situation in vivo. The results indicate that spacer DNA collapses and nucleosomes condense under appropriate ionic conditions. Re-constitution experiments show that H1 histone can link nucleosomes to maintain the conformation of spacer DNA. The three major determinants of the solubility behavior of chromatin are: (1) the amount and configuration of spacer DNA, (2) the cation concentration and (3) the presence of intact H1 histone. The results are consistent with cleaved chromatin fibers being crosslinked longitudinally or laterally by H1 molecules. (Supported by USPHS NIH CA 10871 and T32 CA 09119.

636. Factors Controlling the Composition and Location of Forest in the Big Woods Region of Minnesota. Eric C. Grimm (University of Minnesota)

Detailed maps of the distributions of tree species, with overlays of water bodies, surficial geology, and soils, demonstrate the relationships between these two groups of variables in the Big Woods region of south-central Minnesota. The tree distributions are plotted by computer from data contained in the original field notes of the General Land Office Survey. The patterns on the maps emphasize the primary influence of fire in determining the location and composition of the forest. Water bodies, which restricted the spread of fire, and outwash plains, which did not, almost entirely circumscribe the forest and sharply delimit the prairie-forest border. Trees did not grow on large outwash plains because fire was frequent and widespread there, but mesic trees did occur on smaller sandy areas surrounded by loamy soils, or otherwise well protected. The maturity of forest soils depends primarily upon the time interval of occupation by forest. The maturity of the forest itself depends primarily upon the frequency of fire. Fire frequency and the time interval of forest occupation, as estimated from pollen analysis, are not necessarily related. Forest invaded areas of rugged topography first, but these areas were not necessarily the best protected from fire. Thus, the most mature forest is not necessarily the oldest.

637. Noise attenuation through 10 year-old stands of three species of pine. DILL, NORMAN H., EHSAN M. HELMY, JOHN L. OUTTEN, and CARL D. COFFER (Delaware State College, Dover).

White pine (*Pinus strobus* L.), scotch pine (*P. sylvestris* L.) and loblolly pine (*P. taeda* L.) have been studied. Pink noise was generated perpendicularly to the edges of the 10 year-old stands and at one end of an open field (used as control). Measurements were made at geometrically increasing distances along sound transmission axes (0, 25, 50, 100, 200, and 400 ft.). The effects of pines in attenuating noise which reached the front edge of the stands at 70, 80, 90 and 120 dBA was measured. Differences between sound levels in open field and in pines are interpreted to be largely the result of pines.

638. Laboratory Microcosms as a Tool for Evaluating Ecosystem Theory. JOHN W. LEFFLER (Institute of Ecology, University of Georgia).

Much of the theory explaining ecosystem dynamics is derived from either intuitive conjecture or abstract mathematical reasoning. Empirical evaluation of ecosystem-level hypotheses is difficult due to problems of parameter measurement, time scales, replication, control of systems' histories, isolation from extraneous variables, and economic feasibility. Laboratory microcosms meet the requirements of all ecosystem definitions and may be designed to overcome these problems. While extrapolation from microcosm results must be made cautiously, such systems are appropriate for evaluating the generality of ecosystem-level propositions. This approach first requires rigorous statement of the hypothesis. Microcosms are then designed to isolate extraneous variables and to focus on those processes being evaluated. Experiments assessing the effects of species diversity, nutrient availability, and turnover rates on ecosystem stability illustrate this methodology. Five types of stability were defined empirically and microcosms appropriate for testing each hypothesis were developed. The experimental conclusions suggest that the proposed explanations of stability are insufficient to be generalized to all classes of ecosystems.

639. Water quality in relation to agricultural drainage of Upper Choptank Watershed. FERRIER, JOHN J., NORMAN H. DILL, and JIM O. D. SIGMON (Delaware State College, Dover).

A comparison of water quality conditions in reconstructed and unreconstructed ditches of the Upper Choptank Watershed (Delaware and Maryland) is in progress. The research is part of a broader survey of the ecological effects of agricultural drainage on the natural system. Within the 450 square mile section of the watershed, 23 permanent water quality monitoring sites have been established. Samples are collected at two-week intervals. Less frequent samples are taken at hourly intervals for a 24-hour period. Thirty-four water quality and environmental parameters are being measured. These parameters include physical characters such as, temperature, turbidity, specific conductance, and water level. Chemical characteristics such as, pH, various metals, and nitrogen compounds are also being measured. Biological measurements include B.O.D. and fecal coliform.

640. Role of Silica Availability in Blue-Green Inhibition of Diatom Growth in Eutrophied Waters. KATHLEEN IRWIN KEATING (Rutgers University).

Allelopathic activities of blue-green algal metabolic products have been implicated in determination of annual bloom sequence in eutrophied lakes (1) and have further been suggested as one cause for the replacement of the diatom blooms characteristic of mesotrophic lakes by the blue-green blooms characteristic of eutrophic lakes (1). Autoclave-labile metabolic products of several blue-greens have been shown to interfere with diatom growth. Present studies (involving addition of various levels of Si to pre- and post-diatom bloom lake waters and to cell-free filtrates of blue-green cultures--grown in lake water stripped of organics) indicate that levels of diatom growth in these tests reflect available Si. Half of each lake water or filtrate test sample was autoclaved. Si additions to each of these variations brought all diatom growth curves to similar maximum levels. More Si was required to bring non-autoclaved portions to maxima than was required to bring autoclaved portions to maxima.

(1) K. I. Keating, SCIENCE 196,885; K. I. Keating, SCIENCE (In press).

641. Output of Dissolved Nutrients in Clearcut, Thinned, and Control Loblolly Pine Plots. KONRAD J. BANASZAK (Indiana University-Purdue University at Indianapolis).

Loblolly pine plantings on three east-west trending ridges in north-central Mississippi were used to study the output of dissolved constituents (PO4, NO3, SO4, NH4, Na, K, Ca, and SiO2) from control, thinned, and clearcut plots. Each treatment was performed on the north-facing and south-facing slope. The data from each of the three treatments of north-facing slopes first was compared with matching treatments of south-facing slopes, and no significant difference in the quantity of dissolved output was noted. The runoff from control plots did show significant differences in quality with total PO4 and Ca being higher from north-facing slopes at the 99.9% confidence level (C.L.=99.9). The concentrations of total PO4 and dissolved SiO2 in runoff were different for the three treatments (C.L.=99.9), with the highest values from the clearcuts. The concentration of K in runoff, highest from control plots, also was significantly different (C.L.=99.9) for all ridges. Analysis of the quantity of output of constituents indicated that only PO4 had a difference above the 95% confidence level. This study indicated that 1) phosphate is the nutrient of most interest with respect to forestry practice in the Southeastern United States and 2) measurements of quantity and quality of nutrient loss may give different results with regard to statistical significance.

642. Vegetative Cover Measurements in Strip Mines. JAMES E. CARREL, JOHN E. DEMOTT, DEANN M. ZWIGHT, LESLIE S. BOUCHARD (University of Missouri).*

Vegetative ground cover, an important indicator of strip mine reclamation, can be remotely determined by a simple technique. A silhouette of an entire surface mine and another of the vegetation within it are prepared by darkening clear plastic sheets that overly a large scale, vertical aerial photograph of the mineland. The area of each silhouette is measured by passing it through a LI-COR model LI-3000 leaf area meter and then the percent cover is calculated. Surface observations confirm the accuracy of this novel method for cover values ranging from 0.1 to 97%. Besides allowing one to make rapid measurements of vegetation currently growing in strip mines, the technique permits determination of seasonal and annual changes in vegetative cover. For example, we find 20 denuded strip mines undergoing natural revegetation in Missouri require from 14 to 79 yr to reach 90% ground cover.

*Supported by ERDA contract EY-76-S-02-2758.000 and NSF grant SMI-76-03507.

643. Taxonomic Services of the Insect Identification and Beneficial Insect Introduction Institute, Agricultural Research Service, U. S. Department of Agriculture. LLOYD KNUTSON (USDA), EDNA M. HOOVER (USDA)

The Insect Identification and Beneficial Insect Introduction Institute is the main source of identifications of insects and mites in the Western Hemisphere. Each year nearly a third of a million specimens are identified by research scientists of the Institute's Systematic Entomology Laboratory and by SEL collaborators for federal and state action and research agencies, university researchers, and individuals. The Institute's priorities range from material of importance to biological control and other agricultural research and specimens intercepted by federal and state regulatory agencies to general reference collections. Because of the increasing demands for authoritative identifications and limited sources of supply of taxonomic services, it is especially important that more efficient use of such services be made. Information on the identification service, such as priorities, turn-around time, and condition in which specimens should be submitted, will be available during the poster session.

644. Elemental Profiles in 2 Strains of Growing Chicks. DOUGLAS HAMM and G. K. SEARCY (USDA, ARS, Richard B. Russell Research Center, Athens, GA 30604).

Four male and 4 female chicks from an egg laying strain and also from a broiler strain were sacrificed at 2, 4, 6 and 8 weeks of age. All chicks were reared identically. Analyses of whole bird homogenates were made for Cu Mn Fe Zn Mg Ca K and Pb. Strain and sex did not appear to significantly influence quantities based on live bird weights for these elements. Age did exhibit an influence on the level of many of the elements studied. The most notable was Cu which dropped approximately 70% from two week values to the 8 week values (4.4 ppm to 1.4 ppm). Fe and Zn were lowered about 20% over the six week period. K exhibited a 10% drop. Ca was the only element studied which showed an increase (about 15%). The Ca increase is undoubtedly related to bone hardening as the chicks aged. Mn Zn and Pb remained rather constant over the test period.

645. Response To Color Placement In Betta splendens. KATHY F. VAIL (University of Tennessee at Chattanooga).

Effects of color placement diagrams upon the display mechanisms of *Betta splendens* were determined. The presentation of scale diagrams with specific anatomical color combinations to individual *B. splendens* in a series of trials provided data. The diagrams without coloration, with only natural gill coloration and with gill and tail coloration elicited no response. Several combinations of color and placement caused slight aggressive display, while the diagrams with full natural coloration, with dorsal fins and spread tail coloration and with dorsal fins coloration alone provided the greatest degree of aggressive display recorded.

646. Queen Replacement in Orphaned Colonies of the Fire Ant, Solenopsis invicta. W. R. TSCHINKEL and D. F. HOWARD (Florida State Univ., Tallahassee).

When field colonies of *Solenopsis invicta* Buren were orphaned by removing the functioning queen, recollection 8 to 10 weeks later showed that 61% had from 1 to 99 replacement queens that were physogastric and attractive to workers. Laboratory rearing and later spermathecal dissections of these replacement queens showed that 21% of the colonies had an inseminated queen which produced worker pupae. Of the remaining uninseminated replacements, about 20% nevertheless produced from 1 to 25 worker pupae, probably by thelytoky. According to the presence of worker pupae in orphaned field colonies, 37% of these colonies had an inseminated replacement queen. The remainder produced all-male sexual broods only. Combining lab and field evidence, 27% of all orphaned colonies produced fertile replacements, and these were predominately smaller, younger colonies. The weight of colony queens is related to the mound volume of the colony. The weight of replacement queens is inversely related to the number of such queens in the colony (1 to 99, but over half had only 1).

647. Slow Waves in Hibernator Small Intestine. ALLEN MANGEL(University of Illinois).

The spontaneous slow waves in the small intestine of two hibernators(hamster and ground squirrel) were investigated and found to have slow waves resembling those of the cat. Studies in cat have shown that the sodium pump may be involved in the generation of slow wave activity which may reflect activity of Na-K ATPase(1). In contrast to non-hibernators, the Na-K ATPase of hibernators has been shown to be functional below 15°C(2). We found the slow waves in the hibernator intestine exhibited the same temperature susceptibility as the cat, being eliminated at 15°C. The ability of the ATPase of hibernators to function in temperatures below that of non-hibernators, coupled with their inability to support waves at cold temperatures, indicate reactions in addition to those involving Na-K ATPase are directly involved in slow wave generation. Multireaction systems have been observed in other spontaneously oscillatory systems(3).

1) Connor, Prosser, Weems. J.Physiol. (1974).
2) Willis, Li. Amer. J. Physiol. (1969).
3) Rapp, Berridge. J. Theoret. Biol. (1976).

648. Flock foraging in *Leptonycteris*: Advantages to the Bats and to the host plants D.J.HOWELL(Purdue University)

Leptonycteris forage in flocks; members follow each other and take turns at individual inflorescences. Each bat spends about 0.3 seconds at an inflorescence per pass, yet can consume 4 grams in 30 minutes. This constitutes a full stomach load. Bats then roost as a group on nearby plants or cliffs for about 30 minutes. While roosting they groom pollen from themselves and cluster members.

The 24 hour energy-budget for Leptonycteris is 9.67 kcal/bat. Three hours each night are spent in flight at a metabolic rate approximately 14x SMR, 63% of the 24 hour energy expenditure is spent in 13% of that time.

The advantages of group activity to the bats are decreased search time per individual, and increased digestive efficiency from periodic flock roosting. Likewise, the pattern of flock utilization of single inflorescences at a time improves the probability of nectar being available to the group at the next inflorescence.

The plant resources promote flock foraging by being predictable in time and space. Advantages of flocking pollinators to obligate out crossing plants with multiple inflorescences and copious nectar is discussed.

U.S. Leptonycteris populations are declining dramatically. In areas where Leptonycteris is no longer found, paniculate agaves are setting approximately 1/300th the number of fertile seeds compared to seed set measured in years when Leptonycteris was present or compared to current agave populations enjoying the benefits of bat pollinators.

649. Mechanics of the Mouthparts of a False Click Beetle Larva, Dirhagofarsus lewisi, compared with those of other Beetle Larvae. T. J. Spilman (Systematic Entomology Laboratory, IIBIII, ARS, USDA, c/o U. S. National Museum of Natural History, Washington, D. C. 20560).

In almost all beetle larvae the two mandibles exert force toward the midline of the body to tear or crush food and often to dig through soil or plant matter. The mandible has teeth and grinding surfaces on the medial areas, a large adductor muscle medially and a small abductor muscle laterally, and articular points near the lateral edge. In the false click beetle larva, on the other hand, the two mandibles exert force anterolaterally to dig through wood. To effect a movement so different from the ordinary, the mandible is differently "designed." The mandible has teeth on the medioapical area, a small adductor muscle medially and a large abductor muscle laterally, and articular points near the middle; furthermore, a shearing action of the teeth is effected by an asymmetrical placement of the articular points. The two types of mandibles and the work they do are explained mechanically with models.

650. Development of Substrate Preferance in the Fiddler Crab, Uca pugilator. GARY W. HYATT (University of Illinois at Chicago Circle).

Fiddler crabs (Uca pugilator)were laboratory-reared from the egg through crab stage IX. From crab stage I-VII, 479 animals were exposed for 24 hr, individually, to a 4-way substrate preference blank. The blank consisted of a 55 mm covered plastic petri dish divided into qradrants of 1) moist filter paper (control) 2) high-beach sand, 3) mid-beach sand/mud, and 4) low-beach mud. A change in behavior from surface preference to burrow preference was noted as the crabs grew older, with 80% of stage I crabs preferring to remain on the surface, compared to only 33% of stage VII crabs. Most (53%) crabs preferred low-beach mud, regardless of age, but a shift in preference from low-beach mud to mid-beach sand/mud occurred between stages V-VI, with 40% of stage VI crabs choosing to burrow in that substrate. These data correlate with observations of size/substrate distributions of young crabs in the wild.

651.
The Oxoglutarate Reductive Carboxylation Pathway and Acetyl CoA Production in Vertebrates.
Amedeo F. D'Adamo, Jr., Kuoway Ho and David Roman (York College, Queens, New York 11451)

Acetyl CoA is required in the extramitochondrial compartments for the synthesis of lipids, acetyl choline, acetyl amino acids, etc. A pathway which produces the required C_2 units involving the reductive carboxylation of oxoglutarate has been described (1): Oxoglut. → Oxalosucc. → Isocit. → Cit. → AcSCoA + Oxaloacet. A key enzyme, isocitric synthetase, which synthesizes isocitrate has recently been described (2). This pathway, also termed 'The Oxoglutarate Shunt' or 'Backward Pathway', has been studied in mammals such as rodents where it contributes a significant proportion of C_2 units required for lipogenesis and in ruminants where it does not. In the present studies, liver slices from carbohydrates fed pigeons and frogs were incubated with 5-(^{14}C) glutamate. Comparison of radioactivity in respired CO_2 and fatty acids indicates this pathway also functions in these vertebrates in a fashion similar to that previously observed in rodents. Effects such as fasting and of buffer components such as HCO_3^- will be discussed.
(1) J. Biol Chem. 240, 613; (2) BBRC., 71 712
Supported by U.S.P.H.S. Grant SSO6RR01853.

652. Temperature Effects on r values in Laboratory Cultures of Six Species of Chydoridae (Cladocera). DOROTHY B. PLATT (Temple University)

Isolated parthenogenic females of six species of Chydoridae from the littoral of an oligotrophic Pennsylvania lake were cultured at 10±.5°C, 20±.5°C and 30±.5°C with 14h light, 10h dark. r values were calculated from life tables (Birch, 1948). At all temperatures, C. sphericus, A. harpae, and P. denticulatus had highest r values; A. costata, C. faveformis, and C. piger had the lowest. r values at all temperatures do not appear related to body size or genus. Higher r values in chydorids relate to early onset of reproduction (predicted by Cole, 1954). Comparisons are made between these data and r's from field data. Possible adaptive strategies related to different species' r values and their temperature responses are discussed.

653. The Interaction of Plant Competition and Insect Parasitism in Two Barley Cultivars. P.N. WINDLE (Department of Botany and Institute of Ecology, University of Georgia).

A deWit replacement series was used to analyze plant competition between two barley (Hordeum vulgare L.) cultivars differing in resistance to the greenbug (Schizaphis graminum Rond.: Aphididae). Two cultivar monocultures and three different mixtures were examined both with and without aphid infestation. Insects were associated with overall changes in aboveground and belowground biomass production. Treatments with insects exhibited higher aboveground productivity than the controls two weeks after infestation. After six weeks of aphid feeding, both aboveground and belowground biomass were significantly below that of the controls. Measures of niche separation suggested that insects were able to fundamentally alter the type of competition occurring between the cultivars. Niche separation was a function of cultivar mixture, time, and insect treatment. Values for relative replacement rates showed that insects reversed the time trends in aboveground biomass replacement of the cultivars. Susceptible plants tended to replace resistant plant biomass with their own if insects were absent. With insects, resistant plant biomass increased at the expense of productivity of susceptible plants.

654-683 BIOMEDICAL SCIENCES & HEALTH POSTER TUE., 14 FEB., 3 P.M./ SP EXHIBIT HALL

654. Biosynthesis of an Acute Phase Serum Protein (SAA) Antigenically Related to the Secondary Amyloid Fibril Protein (AA). JEAN D. SIPE (National Institutes of Health, Bethesda, Maryland 20014).

SAA, identified by its cross-reaction with antibodies to amyloid fibril protein AA, is a normal acute phase protein whose concentration in serum can increase 1000 fold within 24 hours, in response to numerous antigenic and inflammatory agents. The effect of cycloheximide (CH), actinomycin D, and galactosamine on the initial acute phase SAA response of C3H/HeN mice to S. typhosa lipopolysaccharide (LPS) has been determined. The SAA concentration began to increase 2 hours after intraperitoneal (ip) injection of 10 μg of LPS. Administration of 5 mg CH or 0.1 mg actinomycin D simultaneously with LPS completely abolished the induction of SAA, up to 8 hours, after which the animals died. CH given during the period 18 to 24 hours post LPS did not reduce an elevated SAA concentration Galactosamine, 5 mg ip, delayed the induction of SAA to 6 hours post LPS. Serum obtained 3 hours after LPS induced an acute phase SAA concentration 24 hours later of similar magnitude to that with LPS. Thus, induction of the acute phase SAA response by LPS is characterised by a lag period of 2-3 hours during which serum mediators appear, and by both RNA and protein synthesis.

655. Serum Progesterone and Aldosterone Levels during the Menstrual Cycle. ANN VODA (University of Arizona).

Serum progesterone (P) and aldosterone (A) levels were determined in 20 ovulating women, ages 18-36, over one menstrual cycle in order to determine the pattern of these circulating gonadal and adrenal steroids hormones. The study was based on previous work in which it was suggested that competitive inhibition of A by high circulating levels of luteal phase P results in natriuresis. Bloods were collected on subjects every other day at the same time to minimize diuranal variation over a 32-day period. Time of ovulation was estimated based on biphasic basal body temperature curves and a midluteal phase increase in serum P of more than 3 ng/ml. Steroids were analyzed using radioimmunoassay technique. A significant correlational pattern between serum A and P over the cycle was identified (r = 0.48, P 0.001). Subjects who had high P did not necessarily have high A values. Mean follicular and luteal phase P were 0.369 ± 0.469 and 5.860 ± 3.755 ng/ml. Mean follicular and luteal phase levels of A were 299 ± 141 and 437 ± 208 pg/ml. These findings suggest that luteal phase increase in A may be etiological of premenstrual edema in women during this phase of the cycle.

656. Effects of the Microbial Flora on Vitamin B-12 Absorption. JAMES B. HENEGHAN and PATRICK A. HATTIER (Louisiana State University Medical Center, New Orleans).

All Vitamin B-12, an essential human nutrient, enters the food chain following its synthesis by microorganisms. To determine if intestinal microorganisms influence B-12 absorption, a test meal of 57 Co labeled B-12 (0.36 μCi, 2,000 pg) was fed to 8 conventional and [illegible] germfree Sprague-Dawley rats (males, avg wt 450 gms) which were bled from the tail vein at 4, 8, 12 and 24 hrs. Rats were placed in metabolism cages and urine and feces were separated, collected and analyzed at 12, 24, 48, 72, 96, 120, 144, 168 and 192 hours. The results, which indicated an increased absorption of Vitamin B-12 in the conventional rats, can be summarized as follows: (a) measured by fecal radioactivity, 37.8 ± 4.1% of the test meal was not absorbed in the conventional rats, whereas, the germfree rats failed to absorb 62.5 ± 9.5%. (b) peak serum levels were higher in the conventional rats 0.9 ± 0.2% than in the germfree rats 0.6 ± 0.3% and the average time to reach the serum peak was shorter in the conventional rats 4.0 ± 0.0 hrs vs 6.3 ± 3.1 hrs in the germfree rats (c) the excretion peak of labeled B-12 in the urine of conventional rats occurred earlier 51 ± 8.5 vs 78 ± 17.0 hrs in the germfree rats. Thus, the presence of a conventional microbial flora leads to increased ability to absorb Vitamin B-12 and emphasizes the need for further investigations on the role of the microbial flora on Vitamin B-12 absorption (Supported by U.S.P.H.S. Grant AM-18886).

657. Thrombin-Induced Lectin Activity of Human Platelets: A Possible Determinant in Platelet Aggregation. T. KENT GARTNER, DANNY C. WILLIAMS (Department of Biology, Memphis State University, Memphis, TN) and DAVID R. PHILLIPS (Department of Biochemistry, St. Jude Children's Research Hospital, Memphis, TN)

Platelet aggregation, a fundamental process in the primary arrest of blood flow, occurs by membrane surface interactions of stimulated platelets. A feasible mechanism is that aggregation is mediated by cryptic lectins and/or lectin receptors which become expressed on the external membrane surface following stimulation. To test this model, lectin activity of human platelets was measured before and after thrombin stimulation. Unstimulated intact platelets were found to agglutinate trypsinized, formalinized bovine erythrocytes. This lectin activity was membrane bound and resided in protein molecules. Furthermore, thrombin treatment of platelets caused enhanced lectin activity which was specifically blocked by amino sugars, but not by N-acetylated derivatives or neutral sugars. Amino sugar inhibition was attributable to competition between the inhibitors and fixed erythrocyte receptors for the platelet lectins. Significantly, sugar derivatives which blocked thrombin enhanced lectin activity also blocked platelet aggregation. None of these sugars significantly inhibited secretion; therefore, they did not prevent platelet stimulation. Thus, these studies suggest that platelet plasma membrane-bound lectins mediate platelet aggregation.

658. The Effect of Serum on Intimal Thickening in Human Aortas Maintained In Vitro. LUCY A. BARRETT (University of Maryland), WOLFGANG J. MERGNER (University of Maryland), BENJAMIN F. TRUMP (University of Maryland)

Segments of human aortas obtained at the time of "immediate" autopsy were maintained in explant culture for up to 5 months with viability of the tunica intima. In the presence of serum intimal smooth muscle cells underwent proliferation and collagen synthesis resulting in an extensively thickened intima by 2 months of culture. Smooth muscle cells from the tunica media proliferated at the cut edges and covered the entire explant. Explants maintained in serum free culture medium remained viable for up to 2 months without proliferation of smooth muscle cells in the intima nor from the tunica media. The results support the role of platelet factors in promoting smooth muscle cell proliferation and atherosclerotic plaque formation. (Supported by the Pangborn Fund from the University of Maryland).

659. Comparison of Cardiovascular Responses of Arterial to Venous Hemorrhage in Neonatal Pigs.

BARBARA J. BUCKLEY, NORMAN GOOTMAN, JOY S. NAGELBERG, PHYLLIS M. GOOTMAN (Long Island Jewish-Hillside Medical Center, New Hyde Park, N.Y., Downstate Medical Center, SUNY, Brooklyn, N. Y.)

Cardiovascular responses to hemorrhage (H) in the newborn were studied in 48 piglets aged less than 1 day to 2 weeks under 0.25% halothane anesthesia. Arterial pH, pCO_2, pO_2 were controlled. Aortic pressure (AoP), heart rate, and femoral, renal and carotid flows (Fs; with electromagnetic transducers) were recorded. H was produced by sequential removal of 5 ml arterial (A) or venous (V) blood to a total of 20-30ml/kg. An age-dependent decrease in $\overline{\text{AoP}}$ was observed with 12.5ml/kg AH: -38%± 5.7 in ≤1 day, -36%± 4.4 in 2-4 day, -22%± 3.2 in 1 week, -8%± $2.\overline{6}$ in 2 week olds. Following VH there was no age-related decrease in $\overline{\text{AoP}}$ in piglets 4 days of age or older. Tachycardia was observed in all piglets following H. All Fs significantly decreased following H; femoral F showed age-dependent decreases with AH. Compensatory $\overline{\text{AoP}}$ responses were lost after AH at: 15ml/kg in ≤1 day, 17ml/kg in 2-4 day, 22ml/kg in 1 week, 25ml/kg in 2 week olds. There was no difference in volume leading to loss of compensation between AH and VH except for the 2-4 day olds in which it occurred at 24ml/kg with VH. Responses to 0.5μg/kg norepinephrine, i.v., were still present in piglets of all ages following AH or VH of 25ml/kg. The inability of the regulatory system to maintain $\overline{\text{AoP}}$ is an indication of its immaturity.
NASSAU HEART GRANT #440

660. In Vitro Modulation of Antigenicity of Murine Lymphoma EL4 Detected in Allogenic Hosts.

T.W. BUDD, C.Y. KUO, and H.N. OROPALLO (Barbara Kopp Geriatric Research Center, Auburn, New York)

Antigenicity of tumor cells has been shown to change in response to various treatments and in vitro culture conditions. In this study, we observed differences in the immune response in allogenic hosts to tumor cells grown in vivo and in vitro. The chemically-induced murine lymphoma, EL4, maintained in C57BL/6 syngenic hosts were used throughout this study. Allogenic hosts were innoculated i.p. with EL4 cells that were either grown in vivo or with cells from an established (10wk) culture line grown on RPMI-1640 with 10% heated fetal calf serum. The time course of tumor rejection was determined by body weight changes compared to control mice. EL4 cells were differentiated from infiltrating host cells in the ascitic fluid of infected mice by microscopic examination and with an antibody-complement dependent cytotoxicity test using monospecific rat anti-EL4 antisera. The cell viability was determined by the trypan blue exclusion test. The maximum tumor development in allogenic hosts was on day 7 and day 10 postinnoculum with in vivo grown cells and in vitro grown cells respectively. peak tumor development was two-fold greater for mice innoculated with cultured EL4. Host cell infiltration varied and was dependent on the source of EL4 cells. In vivo grown EL4 induced early and rapid host cell infiltration. These observations suggest less antigenicity with in vitro grown EL4 cells.

661.

Circadian Models in Experimental Psychopathology and Neurological Research

POIREL Christian (University of Quebec, Chicoutimi, P.Q., Canada)

Several studies concerning the problem of circadian periodicity analyses of murine psychological responses provide heuristical paradigms within the field of medical neurosciences. In mice synchronized by L/D: 12/12 (Light between 08 and 20 hrs; Darkness between 20 and 08 hrs), the greatest emotional events are located at 03^{56} (responses involving preferentially sub-cortical structures] and at 20^{24} (responses involving more corticalized integrations). As for the chronobiological aspect of generalized epilepsies, the highest susceptibility to tonic-clonic seizures is generally observed at 20^{16}. By comparison, the highest level of the central activation modulating brain functions is reaching its maximum at 04^{24}. From chronograms experimentally described, and taking into consideration the rhythmometric procedures, we now have heuristical models for a better understanding of psychophysiological and neurological processes in human beings. More generally, some neurobiological disorders would be tied to an underlying circadian rhythm whose molecular mechanisms (chain DNA-RNA-Proteins) and meso-diencephalic brain integrations appear to be of considerable theoretical and clinical interest.

662. The Role of Glutamic Acid in Alcohol Dependence.

William J. Freed and Elias K. Michaelis (Univ. of Kansas).*

Seizures occur in mice during alcohol withdrawal; we have found that these are greatly decreased by the glutamate antagonist glutamate diethylester. This finding led us to suspect that supersensitivity to glutamate in the CNS is a cause of the ethanol-withdrawal reaction. Two experiments were performed to test this hypothesis.

Kainic acid, an analogue of glutamate, was given to mice receiving ethanol chronically by inhalation, and to normal controls. At a dosage level that caused convulsions in 20% of normal animals, kainic acid caused convulsions in 76% of animals treated chronically with ethanol ($p=.0008$, Fisher exact test). However, pentylenetetrazol, a convulsant that is not known to act via glutamate, did not affect normal and alcohol-dependent animals differentially.

In a second experiment, it was found that administration of ethanol by ingestion for 8 or 16 days increased rat brain synaptosomal glutamate-binding activity. These changes appeared to be primarily due to an increase in the maximum binding capacity of the sites rather than to changes in affinity for the ligand. Acute administration of ethanol in vivo did not cause similar changes. The findings are consistent with the hypothesis that a supersensitivity to glutamate appears during chronic exposure to ethanol and contributes to the phenomena of ethanol dependence and withdrawal.

* Supported by NIAAA grant AA01911. WJF is now at the NIMH.

663. Inability of Morphine to Induce Analgesia In Reptiles.

GARY E. DUNCAN, MICHAEL J. BANNON (University of Louisville).

Although the results of pharmacologic stimulation of opiate receptors in mammals are well characterized, the natural function of the "endogenous opiates" has not been fully elucidated. The presence of stereospecific opiate receptors has been demonstrated in the central nervous systems of all vertebrate species examined, from fish to man (1). We therefore decided to determine if morphine could induce analgesia in reptiles, since these phylogenetically ancient animals apparently have opiate receptors similar to those found in mammalian species (1). We found, using the hot-plate test, that morphine in doses which were orders of magnitude larger than those required to induce analgesia in rats, produced no analgesia in the reptilian species tested (iguanas and basilisks). The apparent lack of analgetic effects of morphine in the reptiles studied implies a function other than autoanalgesia for the opiate receptors in these animals.

1. Brain Research. 75 (197[illegible]) 356-361.

664. Defense Mechanisms against Cyanide Poisoning.

LENA B. BRATTSTEN (Cornell University), JAMES C. BLANKENSHIP (Cornell University).

Arthropods are from five to several hundred times more resistant to cyanide poisoning than vertebrates. Many other invertebrates, plants and microorganisms are also cyanide insensitive. Cyanide is of very widespread occurrence in nature. Several mechanisms have been suggested to confer cyanide resistance to organisms. Hypotheses of an altered target site include an alternate cyanide-insensitive respiratory pathway which is also insensitive to antimycin but is inhibited by aromatic hydroxamic acids and presumably located on the outside of the inner mitochondrial membrane. A modified cytochrome c oxidase, insensitive to cyanide binding has been proposed as well as an excessive concentration of cytochrome c oxidase. In addition to being channeled into the intermediary amino acid metabolism and vitamin B_{12} equilibria, elimination mechanisms include the enzymes E.C. 2.8.1.1., thiosulfate: sulfurtransferase, (rhodanese) and E.C.2.8.1.2., cyanide: sulfurtransferase, both of which convert cyanide to the 200 times less toxic metabolite thiocyanate, provided that a sulfur donor is present in suitable ratio. Cyanide is stored as inactive glycosides in plants and as nitriles in arthropods and are separated from the cyanide releasing enzymes. Increased metabolic capacity may account for the ability of many organisms to withstand chronic exposure although a combination of several mechanisms is necessary to explain the resistance to doses which would be lethal to vertebrates.

665. The NMR Detection Of Malignancy In Human Tissue.

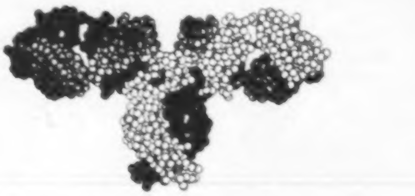
M. GOLDSMITH, J. KOUTCHER, R. DAMADIAN (State University of New York).

Over eight hundred (800) specimens of human tissue taken from six hundred and fifty (650) individuals, were inspected by proton magnetic resonance techniques (at 22.5 Megahertz). The purpose of the study was to evaluate the diagnostic capabilities of the nuclear magnetic resonance (NMR) technique with regard to the detection of malignancy. The combination of two NMR parameters (spin-lattice (T_1) and spin-spin (T_2) relaxation times) into a malignancy index yielded excellent discrimination between the two populations of tissue. In gastro-intestinal tissue, for example, the mean and standard deviations obtained were 2.004 ± 0.342 for normal tissue, and 3.266 ± 0.642 for malignant specimens. In addition, breast specimens exhibiting fibrous mastopathy, or fibrocystic disease had mean indices insignificantly different from control tissue, whereas breast malignancies could be distinguished from control tissue on a case by case basis with higher than 95% confidence.

666. The Three-dimensional Structure of an Intact Immunoglobulin.

MANUEL A. NAVIA, DAVID R. DAVIES, ENID SILVERTON (Laboratory of Molecular Biology, National Institute of Arthritis, Metabolism and Digestive Diseases, National Institutes of Health, Bethesda, MD 20014)

The electron density map of an intact human immunoglobulin IgG1 has been interpreted with the aid of coordinates from known Fab and Fc fragment structures. The molecule is roughly T-shaped but appears flexible enough to assume a Y-shape. The carbohydrate moiety plays an important role in the structure as the principal contact between Fc and Fab, and between the domains of the CH2 region of Fc.



667. Pharmacological Activity in Agents Isolated from the Blue-Green Algae *Oscillatoria williamsii* and *Agmenellum quadruplicatum*.

SHAYNE COX GAD (Carnegie-Mellon Institute of Research) and ROBERT GRAVES BROWN (University of Texas).

The smooth muscle depressant activity present in the growth supernatants of the two blue-green algae *Oscillatoria williamsii* strain MEV and *Agmenellum quadruplicatum* strain PR6 was due to extracellular organic agents. One active agent was isolated from MEV and two from PR6. The higher molecular weight agent from PR6 had a molecular weight of 303, possessed at least one amine function and was composed of 6.54% H, 52.77% C, and 10.85% N. This agent was shown to be an extracellular product of the normal growth of PR6 and to have a U. V. absorbance peak at 259 nm. The smooth muscle depressant MEV agent and higher molecular weight PR6 fraction had LD50's of 53 and 46 mg/kg, respectively. These two agents relaxed all smooth muscle preparations they were assayed with. Double reciprocal plots of data from a wide variety of isolated tissue assays (interpreted in a manner analogous to the interpretation of Lineweaver-Burk plots in enzymology) indicated that the MEV and PR6 agents acted in a competitive manner with each other but were not active at the classical receptor sites (muscarinic, nicotinic, α adrenergic, β adrenergic, dopaminergic, tryptaminergic, histaminic, kinin, or endorphan sites). However, the PR6 agent did have significant activity as a membrane stabilizing agent at concentrations of 10^{-6}M to 10^{-4}M. The PR6 agent also significantly depressed the stimulatory effects of (+) amphetamine on mouse locomotor activity.

668. Carcinogenesis by Polycyclic Aromatic Hydrocarbons: The Bay-Region Theory.

J. M. KARLE, R. E. LEHR, H. YAGI, D. R. THAKKER, and D. M. JERINA (NIH, Bethesda, Md.), A. W. WOOD, W. LEVIN, and A. H. CONNEY (Hoffmann-La Roche, Nutley, N. J.).

In order to explain the carcinogenic actions of benzo[a]pyrene (BP), the bay-region theory of carcinogenesis has been developed. The bay-region theory predicts that the metabolically-formed diol epoxides on saturated, angular benzo-rings in which the epoxide forms part of the "bay-region" are highly reactive chemically and may also be highly biologically active. Numerous lines of evidence have now implicated the 7,8-diol-9,10-epoxides of BP as ultimate carcinogens. In order to extend this theory to encompass polycyclic aromatic hydrocarbons in general, the five possible vicinal *trans*-dihydrodiols of benzo[a]anthracene (BA) and the three possible dihydrodiols of chrysene (CHR), as well as epoxide derivatives related to these hydrocarbons and dihydrodiols were synthesized and tested for mutagenic and carcinogenic activity. BA 3,4-dihydrodiol, BA 3,4-dihydrodiol-1,2-epoxides, and CHR 1,2-dihydrodiol displayed the highest mutagenic activity towards bacterial and mammalian cells. In initiation-promotion experiments on the skin of CD-1 mice, BA 3,4-dihydrodiol, the metabolic precursor to the bay-region diol-epoxide, and BA 3,4-dihydrodiol-1,2-epoxide were more tumorigenic than BA itself. BA 3,4-dihydrodiol produced more pulmonary adenomas than BA in newborn mice. These results are consistent with and supportive of the bay-region theory of carcinogenesis.

669. Febrile Responses of Ectotherms to Bacterial Pyrogens.

W. W. REYNOLDS, M. E. CASTERLIN & J. B. COVERT (The Pennsylvania State University).

The phenomenon of behavioral fever, manifested as an increase in preferred temperature in response to pyrogens, has been demonstrated in several species of aquatic ectotherms, including fishes, amphibians, and crayfish. Pyrogens eliciting this febrile response include live and killed gram-negative bacteria (*Aeromonas hydrophila*), purified endotoxin from *E. coli*, and killed gram-positive *Staphylococcus aureus*, as well as prostaglandin E_1. Antipyresis (via acetaminophen) has also been demonstrated in fish. The magnitude of the febrile responses range from 1-6°C above the normal thermal preferendum of the species. Fever enhances survival from *A. hydrophila* infection in goldfish (as in lizards), apparently by accelerating immune processes. The latter aspect is under current investigation. These findings along with similar results from other investigations with terrestrial reptiles and amphibians suggest that fever is a phylogenetically ancient and widespread adaptive mechanism which enhances host defense reactions to infection.

670. ^{1}H NMR Studies of the Binding of Carbohydrates to the Myelin Basic Protein.

ROBERT ROWAN, III, ANTHONY T. CAMPAGNONI, and DONNA WHITEHEAD (Chem. Dept., University of Maryland)

We have observed an unusually shielded resonance in the ^{1}H NMR spectrum of myelin basic protein (MBP) prepared by chromatography of the protein on CM-Sephadex under strongly acidic conditions. In view of the known capacity of the protein to bind carbohydrate-containing ligands (such as cerebrosides and gangliosides) we have performed several reconstitution experiments using dextrin and purified MBP. The same unusual ^{1}H resonance appeared in mixtures of dextrin and purified MBP, while no such resonance was present in the spectrum of either substance alone. These data suggest that degradation products of the CM-Sephadex released during acid chromatography of the protein bind specifically and strongly to MBP. The interactions of MBP with dextrin and glucose were further examined at a variety of pH's. At pH 4.5 only dextrin caused the upfield peak to appear in the ^{1}H NMR spectrum of MBP, while at pH 2.5, changes occurred in the spectra of both the MBP-glucose and MBP-dextrin mixtures. These data suggest that both dextrin and glucose bind specifically to the myelin basic protein, and that ^{1}H NMR spectroscopy may provide a sensitive means of following this interaction.

671. The Reduction and Oxidation of Myoglobin and Hemoglobin Using a Surface Modified Gold Electrode. JOYCE F. STARGARDT and FRED M. HAWKRIDGE (Department of Chemistry, Virginia Commonwealth University Richmond, VA 23284).

Myoglobin and hemoglobin undergo direct electron transfer at solid electrodes at a very slow rate. Direct oxidation or reduction at a solid electrode is not feasible for quantitative analysis of myoglobin or hemoglobin using electroanalytical methods.

Gold minigrid electrodes modified with 1,1'-dimethyl-4,4'-dipyridinium dichloride exhibit quasi-reversible rates of reductive and oxidative heterogeneous electron transfer with myoglobin and hemoglobin. The drastic alteration in the rate of heterogeneous electron transfer effected by the surface modification indicates that direct amperometric analyses for these two molecules is possible. The possible clinical utility of these results will be presented.

672. Neurotoxins: 6OHDA and Ascorbic Acid Produce Seizure Activity. FLORRY P. BOWEN (Bronx VA and Mt. Sinai School of Med.) and ROBERT KATZMAN (Albert Einstein Med. Center)

Topical application of 0.1 cc. of 10^{-3} M solution of 6-OHDA was applied to the right sensorimotor cortex of 7 rabbits and 6 cats. EEG recording from epidural electrodes revealed both focal and generalized seizure activity beginning within 24 hours and lasting up to two weeks. Implanted controls of either saline pledgets or stab wound lesions did not exhibit epileptogenic foci. The ability of 6OHDA to produce seizure activity both in cerebral cortex and other neuroanatomical structures should be taken into account when considering the many physiological, behavioral and pharmacological responses reported with this substance.

Since ascorbic acid is the usual vehicle for 6OHDA, it was found that in applying this substance alone, seizure activity could be produced in 3 out of 3 rabbits. This suggests that this compound may be a neurotoxin under such conditions.

Supported by Bronx VA Grant, Clin. Center for Res. on Parkinson's Disease and Allied Diseases 3P50NS11631, Grants NS 11631 and NS09849 from US Public Health Service

673. Somatic Correlates of Adolescent Drug Abuse. MCBEE, GEORGE, Ph.D., (Texas Research Institute), CLAGHORN, JAMES, M.D., (Texas Research Institute).

The purpose of this study was to compare physical illness differences of patients seeking psychiatric help for drug abuse problems with other mental patients. Comparison between these patient groups afford useful insight into treatment planning. Consequently, a 436-item questionnaire (history and current health status), laboratory evaluations (CBC, SGOT, BUN, Rapid Protein Reagin, Gonosticon Dri-Dot, cholesterol, glucose, sickle cell, and complete urinalysis), physiological testing (weight, height, respiration, blood pressure, pulse, temperature, vision, hearing, tonometry, and spirometry) and physical examination were carried out for 403 heroin addicts on methodone maintenance and 297 chronically or acutely psychotic individuals. A striking pattern of physical illness differences emerged between the two patient groups. Fertility and pregnancy dysfunctions were significantly higher for the drug abusing women while venereal disease was much higher for all drug abusers. Liver and pulmonary diseases were higher for the drug abuse sample as well. The differences in physical diseases between the two patient groups were quite pronounced and led to the conclusion that a complete health examination was a critical factor in adequate treatment planning in a psychiatric facility.

674. Manual Review of Outpatient, Drug Prescribing: Development and Testing of Cost-Effective Screening Methods. DA KNAPP, B BRANDON, & DE KNAPP (School of Pharmacy, University of Maryland, Baltimore, MD 21201).

Manual, retrospective, explicit criteria, screening methods* to review probability samples of drug prescribing were developed and pilot tested. Such specifications permit drug prescribing review (DPR) to be objective, effective, and efficient and thus meet the needs of programs that cannot afford complex, computerized DPR. The first method reviewed the individual prescription (Rx) for daily dose and days supply and used McBee Keysort^{TM} cards; it was tested on rural and urban OEO Neighborhood Health Centers in 5 states. The second method utilized the additional criterion of diagnosis--drug appropriateness and used coding sheets instead; it was tested on various rural and urban ambulatory care centers in 4 states. The final method utilized Medicaid patients' Rx profiles for a 3-month period and screened on drugs of choice, daily dose, entire therapy length, drug holidays, disease-drug and drug-drug interactions, and refill patterns. All methods were implemented successfully, thus providing several choices for groups wishing to do DPR. With all methods, prescribing problems were detected that involved the majority of prescribers across all types of drugs. Detailed analyses showed the methods to be cost-effective.

*Terms used in accordance with PSRO definitions.

675. Operational Validity of the Problem-Oriented Medical Record. RICHARD H. ALLEN, DRPH (Texas Research Institute of Mental Sciences), GEORGE MCBEE, PHD (TRIMS), EDWIN JOHNSTONE, MD (TRIMS), LINDA J. WEBB, DRPH (TRIMS).

The purpose of this study was to establish the concurrent validity of the graphic section of the problem-oriented medical record in a large community mental health center. Pre-treatment and three month follow-up interviews were conducted with a series of clients who represented a sample of admissions to a general psychiatric outpatient clinic. Independent psychological and sociological functioning assessments were made. This information was compared with the problem-oriented record information to determine the validity of the therapists' ratings of severity. Spearman correlational analyses were carried out to test the validity of the record. A number of significant results was observed. The study showed substantial correlation for changes in levels of severity in the record with changes in measures of anxiety and social dysfunctioning over time. The problem-oriented record was found to be a strong basis for the application of operations research to mental health services.

676. Partial Dissociation of Blood Pressure and Induced Muscle Tension. S. THOMAS ELDER (University of New Orleans), ELIZABETH A. VERZWYVELT (University of New Orleans), and ROBERT MCAFEE (Veterans Administration Hospital, New Orleans).

The purpose of this study was twofold: (1) to attempt to replicate a previous study in which subjects were trained to raise and lower their diastolic BP as much as 10% to 15% of baseline, and (2) to determine whether subjects could acquire a BP response under conditions of induced muscle tension. A 2 by 3 design was used in which subjects were randomly assigned to one of two training procedures (feedback versus no feedback), and one of three muscular tension conditions. Acquisition took place over 14 sessions; 7 were used to train an UP response, and 7 were used to condition a DOWN response. Results showed subjects in the UP condition learned to raise their BP in the absence of induced tension but not when tension was present. Subjects in the DOWN condition learned to lower their BP with and without induced tension, although their performance under the tension condition was only marginally significant.

677.
Analysis of Pediatric Blood Lead Levels in New York City for 1970-1976. IRWIN H. BILLICK, Ph.D., (Dept. of Housing and Urban Development). ANITA S. CURRAN, M.D., M.P.H., (NYC Dept. of Health). DOUGLAS R. SHIER, Ph.D., (National Bureau of Standards).

A data base of over 300,000 pediatric venous blood lead levels (BLL) and supporting demographic information is available for New York City from 1970-1976. Analysis has been carried out on 178,588 records which are positively identified as first screening samples. The population was disaggregated into subgroups characterized by ethnic group, age, sampling date and, in some cases, location. The distribution of blood lead levels of these subgroups can be described by log-normal distribution functions characterized by the geometric mean (GM) and standard geometric deviation (SGD). The GM plotted against sampling date shows a cyclic variation of BLL, with peaks in July-August, superimposed upon an overall decrease with year for all ages and ethnic subgroups. The GM's for Blacks are greater than for Hispanics, which are equal to or slightly higher than Whites. Similar variations are observed from specific sampling locations. A similar cyclic variation, with a continuing yearly decrease, has been recorded for air lead measurements at a single location in Manhattan. Using these air lead data as an indicator, high correlation is obtained from a linear regression analysis of the log (ave. yearly GM) vs. air lead for constant ethnic group and age sub-populations.

678. Tin in the Air and Digestive-Urinary Cancer. RICHARD HERBERT FRANKE (University of Wisconsin-Milwaukee).

Enzyme systems in the body provide a natural defense against some cancer-inducing chemicals by catalyzing their transformation into water-soluble forms which can be eliminated from the body. Many carcinogens, as well as drugs and endogenous substances such as steroid hormones, stimulate the body's production of these protective enzymes. However certain heavy metals stimulate instead depletion of the enzymes and degradation of the heme which contains them. In particular, tin has been found to induce degradation of heme in the kidney and decrease of the microsomal cytochrome P-450, concomitant with a decrease in elimination of drugs and presumably of carcinogens. Measures of tin and other heavy metals in the air for two sets of twenty-four U.S. metropolitan areas are related here to the age-adjusted cancer death rates of white males and white females in these areas. A substantial, replicated pattern of association is shown only for tin and cancers of the digestive-urinary system, with death rate variance explanation as high as 50%. In particular, death rates from cancer of the esophagus, stomach, large intestine, rectum, and urinary organs are correlated concurrently with tin levels in the air of the metropolitan areas. There is no clear indication from these analyses that other metals play an important role in digestive-urinary or other cancer death rates, but there is some indication of a role for tin in cancer of the breast, lung, and liver.

679. Relationships between Air Conditioning and Heat-Related Mortality: An Ecological Approach. CAROL J. HAZARD, WINSTON C. LIAO (University of Mississippi).

Adverse effects of air conditioning on human health have not been as extensively investigated as those due to heat stress. The purpose of this study was to examine the relationships between air conditioning, socioeconomic factors, and selected heat mortality rates for 82 counties in Mississippi. Census and vital statistics data were used in a stepwise regression approach for describing these relationships. Central air conditioning system was found to be the best explanatory variable for both heart diseases and general mortality, accounting for 42% and 53% of their overall variances, respectively. The variable two or more air conditioning room units was among the top three explanatory variables for cerebrovascular disease and respiratory diseases. These relationships were further analyzed by controlling for the various socioeconomic factors. The findings suggest that at the aggregate level, lack of air conditioning might be associated with increased mortality rates. However, certain mediating socioeconomic factors appear to influence these relationships. A conceptual approach is proposed for further ecological and in situ studies of this health problem.

680. Survey of Smoking Policies in U. S. Hospitals. NORMA R. KELLY (University of Illinois), FELISSA L. COHEN (University of Illinois).

Growing conflict between the rights of the nonsmoker and the rights of the smoker can be seen in the hospital setting. As health agencies, hospitals can be viewed as having a mandate to promote positive health policies. A self-administered questionnaire was sent to the administrators of general hospitals. The sample (20% of the total) was randomly selected from a list of A.H.A. accredited general hospitals in the continental U. S. Of the 357 hospitals so selected, 328 returned the questionnaire, giving a return rate of 92%. Information was gathered as to the present overall smoking policy, dimensions of resistance (if any) for limiting smoking, description of smoking regulation for specific areas, patients, visitors and personnel, the availability of cigarettes on hospital premises, the size and type of hospital; and the attitudes of the hospital administrator toward responsibility in encouraging nonsmoking. The administrator's own smoking habits were ascertained. The data were cross-tabulated to determine the degree of relationship between several variables and these results will be presented.

681. DDT Residue Concentrations in U.S. Agricultural Soils: 1968 to 1973. ANN E. CAREY (U.S. Environmental Protection Agency, Washington, DC)

Organochlorine pesticides were monitored in soils of the major agricultural areas of the United States between 1968 and 1973. Results of these monitoring studies have shown that agricultural soils are widely contaminated with low concentrations of chlorinated hydrocarbon pesticides. The most frequently occurring residues for most of this time period were isomers and metabolites of DDT. Between 1968 and 1973, concentrations of DDTR (the sum of six DDT isomers and metabolites) in agricultural soils exhibited a declining trend. This decrease in soil DDTR contrations was probably a result of the declining use of DDT in the late 1960's as more reports documenting its effects were circulated in scientific and popular journals, and publicity on federal regulatory actions which finally resulted in cessation of most DDT uses in 1973. Similarly, concentrations of specific isomers and metabolites such as p,p'- DDT and p,p'- DDE also declined during this period. These declines in DDT isomers and metabolites indicate that the DDT group of compounds (DDT, DDE, TDE) are being removed from agricultural soils either through biological or non-biological decomposition to simpler organic compounds, translocation to vegetative biomass being produced, or erosion.

682. Nutrition of College Students. THEODORE BERLAND (Columbia College and Michael Reese Hospital, Chicago).

Eating habits and daily nutrition of the wild species American College Student have eluded careful and detailed study and analysis. However, during a course in nutrition conducted by the author, students were assigned the task of keeping diaries of their eating, and analyzing the content of what they ate. The data show that the range of daily calories (kilocalories) consumed by 22 students ranged from a low of about 500 to a high of more than 3,000 with an average total of about 1,700 calories. While the statistical average indicated an adequate intake of protein, and other nutrients, individual totals ranged from far less than adequate, to far more. Comments will be made of the students' dietary practices and their relation to vegetarianism, Adelle Davis, low economic status, natural foods, and misinformation. This limited study indicates a lack of practical nutritional education at lower levels of education.

683. **The Golden Age of Nutrition Lies Ahead.**
Archibald T. McPherson, Science Writer.

Many activities now in progress are leading toward a Golden Age of Nutrition. Current research is now completing the identification of the essential nutrients and is determining the optimal amounts of each in the diet. Vitamins, amino acids, and other nutrients required in the lesser quantities are manufactured by chemical synthesis and are used extensively to make up for deficiencies in the diets of man and animal. Such supplementation, however, is not enough. In many countries the food now grown, even in good weather, is not enough to satisfy the hunger of the multitudes of the poor. The future will indeed be precarious unless and until the acute need can be met by extending synthetic production to carbohydrates, fats, and proteins. These basic nutrients can be used to make products identical to natural foods in composition, nutrition, and taste. Resources for large scale manufacture are now available in terms of manpower, raw materials, basic scientific knowledge, engineering know-how, food technology, and management capability. Needed for getting started are: (1) the preparation of a comprehensive, interdisciplinary program of research, development, production, and distribution; and (2) a political determination at top level to provide adequate support for the program.

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684. Information Sources Used in Everyday Problem Solving.
ROBIN D. CRICKMAN (University of Oklahoma).
Information and referral centers which advise citizens on where to obtain help with personal problems are generally started in communities that have sufficient monetary or volunteer resources to support such an activity. Information planners give little attention to whether the target community would normally use such a center as an information source. This paper reports the results of a survey of new community residents undertaken to determine which sociodemographic characteristics correlate with usage of which types of information sources. Sources of information used for everyday problem solving were divided into two types: public sources, defined as those sources available to and identical for all people -- such as the telephone book; and private sources, those specific to an individual -- such as friends and neighbors. Usage of public sources correlated with characteristics generally ascribed to middle class people while private sources were more frequently favored by lower class individuals. This finding is particularly important because information and referral centers, a type of public source, are often set up to serve lower class groups. Thus, information and referral centers that disseminate public welfare information should reconsider their mission, both with respect to clients who would not normally use such an information source and also for those who would like to use the center but are excluded from the client population.

685.
Vocation and Evocation: The Cabbie-Client Relationship in a black-operated Jitney (Gypsy) System.
PETER T. SUZUKI (University of Nebraska at Omaha).
A number of participant-observation studies of the cabbie-client relationship exist. The classic is Fred Davis' paper of 1959. In it, he noted the discontinuity in the relationship between the cabbie and his fare. Subsequent studies tend to support his basic thesis (e.g., Henslin 1967, 1972; Stannard 1971; Vidich 1973, 1976). However, these studies were executed by white drivers studying white-operated cab companies (cf. Ianni 1974).
This paper is based on participant-observation fieldwork as a driver for Omaha's black-operated jitney cabs. As such, it is the first study by a non-white of a minority (black)-operated quasi-legal livery system. Because of the commonality of race, experience, and ethos ("trying to survive in the System"), the relationship which obtains between jitney driver and passenger is a warm and caring one, in sharp contrast to that which prevails in white cab systems. The vocation of jitney cabbie is seen by passengers (all of whom are blacks) as an important one because cabbies provide a useful and needed service. Accordingly, this perception evokes an empathetic and concerned attitude toward drivers. Reciprocally, such an evocation reinforces the self-esteem and worth of drivers as craftsmen. The final outcome is an integrated relationship that helps strengthen solidarity in Omaha's black community.

686. Life Expectancies of Couples by Age Combination of Spouses. S. MITRA (Emory University).

The probability of the eventual termination of marriage by death of one of the spouses is found to be influenced more by their age difference rather than by their actual ages. Naturally, the probability of becoming a widow increases with the husband-wife age difference and in the U.S. this probability increases from two-thirds to three-fourths as the age difference increases from two to seven years.

The average number of years lived as married by the U.S. males (including all marriages) would not be affected by the prohibition of divorce and remarriage. In comparison, the females, in spite of divorces and remarriages, spend fewer years of their lives as married. Thus, remarriage barely compensates for divorce among the males while its contribution to the total number of married years among the females is small compared to the loss suffered from divorce. This coupled with the facts that women are married to men who are older in age and that the life expectancy of women is greater than men (by about 7 years at birth for U.S. population), tends to lower the proportion of the life cycle that a woman lives as married.

687. Multiple Measures with a Concurrent Validity Measure in Interview Research on Drinking Drivers. JAMES D. HUBER (Indiana-Purdue University at Fort Wayne), MARTY E. ZUSMAN (East Carolina University).

Drivers were stopped on city streets on weekend nights in a large Midwest city. In the course of a 5 minute interview, 4 measures of alcohol consumption were made. Interviewers indicated a personal initial reaction as to whether the driver had been drinking. Second the interviewers attempted to observe the presence of positional alcohol nystagmus by asking drivers to tilt their heads. Third, drivers were asked if they had been drinking alcohol. Finally a breath sample was taken and later assayed for alcohol. Analysis, using the breath sample as a criterion measure, indicates that interviewers were conservative in their estimate, making a high percentage of false negatives, and conservative in their observations, indicating "can't tell" most often in positive cases. A high percentage of drivers gave false negatives although false positives also occurred. Situational factors are suggested for future analysis and cautious multiple measure research in sensitive areas suggested.

688. Sociogenetic Bases of Incest Avoidance.
DUANE QUIATT (University of Colorado, Denver).

Low incidences of close inbreeding (mother/son, brother/sister) in a wide range of nonhuman primate and other mammalian species suggests common factors operating to inhibit such behavior. One factor which would operate in a similar way across species is genetic selection, and the inclusive fitness of close inbreeding individuals appears to be reduced by more than fetal wastage and offspring mortality associated with high homozygosity. Parental investments are not equivalent in mother/son, father/daughter, and brother/sister matings; different genetic costs and benefits of these matings can be compared and assessed in relation to varying sanctions against and known frequencies of incest in human societies. A major virtue of this approach is not that it "explains" incest taboos but that it leads to a biologically meaningful distinction between incest aversion and incest proscription.

689. Dominant Caste And Socio-Economic Structure In The Villages of North India. HARRY BLAIR (Bucknell University).

That villages in India tend to be dominated by a particular caste or jati is well known. It is also well known that in any given region, different jatis will dominate different villages. But are there any characteristics differences in village dominated by one jati as opposed to another? Are there any demographic characteristics that are distinctive of "high caste" or "low caste" villages? These questions have not thus far been rigorously examined. They will be taken up in this paper. The research design is to see whether one can on the basis of census data (from 1961 and 1974) assign polling stations (a polling station is generally an aggregation of 2 or 3 villages) of two constituencies to groups that differ significantly inter se and then to see whether these groups of polling stations correspond to a classification of stations according to dominant caste. In each constituency there are three major caste groups that dominate a sizeable number of booths. Discriminant analysis is the statistical approach used and indicates that over 70 percent of the polling stations can be grouped on the basis of the census data into categories that match up with a classification by dominant caste. In other words, villages dominated by different castes have demographic characteristics that are significantly different.

690. Monaural Phase Effects in Auditory Temporal Resolution. K. N. WILLIAMS, W. R. HOWSE, L. F. ELFNER, and R. R. STANNY (Florida State University).

Monaural detection of brief gaps between tonal stimuli was enhanced when the offset of the first tone burst and onset of the second tone burst were made disparate by systematic variation of their phase relationship. In a two interval forced choice trained observers were required to select the stimulus complex containing the phase disparity (0, 90 or 180°) at each of five frequencies (313, 625, 1250, 2500 and 5000 Hz) and two gap durations (1 and 6 msec.). Results indicate significant effects for phase disparity, frequency, and gap duration and also indicate a significant interaction between phase and frequency. Implications for a two-filter model of auditory temporal processing are discussed.

691. Mathematical Model for Inhibitory and Facilitory Interactions in the Perception of Extent. DR. TED JAEGER (University of Georgia).

Brigner and Kauffman (1974) have demonstrated that arranging a series of parallel lines across space in accordance with a Mach pattern produces increments and decrements in extent at the inflection points of the line pattern. They also found that moving the lines composing the Mach pattern closer together resulted in an overall increase in apparent line length. These findings indicate that there are both inhibitory and facilitory interactions in the parallel lines version of the Muller-Lyer illusion. By varying inducing contour length and separation from the test contour I found that these interactions and their consequent effects on apparent contour length can be described by the convolution transform

$$A(x) = k^{-1} \int P(x-\xi)W(\xi)d$$

where $A(x)$ is the apparent extent of a test contour, $P(x-\xi)$ is the physical extent of the test and surrounding inducing contours, and $W(\xi)$ is a weighting function specifying the strength of the inhibitory or facilitory effects produced by the individual inducing contours. This model predicts the distortions seen in the Muller-Lyer, Ponzo, Delboeuf, and Ebbinghaus illusions.

692. Standardized Aptitude Testing: Is Merit Measurable?

DOUGLAS A. SAMUELSON (Federal Preparedness Agency), CARLYLE MAW (National Institute of Education)

Standardized tests of mental aptitude are validated primarily by their ability to predict scholastic success, and their widespread acceptance appears to be attributable more to their empirical performance than to their theoretical foundations. Our review of the history of IQ and aptitude testing suggests that the tests' predictive powers stem more from the robust statistical procedures by which they were developed than from any underlying theory of human aptitude. Since many of these statistical procedures were used intuitively and in some cases were not elaborated in statistical theory for some years afterward, the theory of testing does not fully reflect the state of the statistical art. Therefore, it is possible that substantial improvement in predicting scholastic success could be achieved by a major reassessment of the methods of prediction. Further, the dependence of current testing theory upon statistical assumptions and its possible sensitivity to changes in those assumptions raise questions about the extent to which academic merit can be quantified by any procedure.

693. School Age Smoking Behavior: An Ethnographic Approach.

B HOWE (Dept of Sociology), C CAVE & S GRAHAM (Res Program in Soc Epidemiology & Cancer Control, SUNY/Buffalo, NY)

As a prerequisite to smoking prevention and intervention in schools, we proposed that the specifics of contemporary peers' subculture be identified and described. Our goal was to identify early adoption patterns of smoking. Both ethnographic techniques (including small group discussions and essay exercises) and survey methods were applied. Respondents were 145 students in grades 4 through 8 in 3 schools of one suburban system. The survey indicated that 61% of students had tried cigarettes by 8th grade. Only 5.4% said that they were regular smokers; however a comparison of this figure with the 19% who said that their best friend smokes suggests that students overestimate the amount of smoking among their peers. Our ethnographic data on the student subculture indicated existence of clearly delineated ranking system for sub-groups in the population on such parameters as sex, sexuality, age participation in student activities, and dress style. Initiation-of-smoking patterns varied considerably among these strata, as did a number of other types of behavior, e.g., using cannabis. The higher the grade, the more precise and sophisticated were student descriptions of their social structure and the relationship of smoking to clique membership. If it is possible that groups whose members smoke can be characterized, then programs tailored to their subcultures can be designed to motivate them to alter their behavior. Ethnographic techniques appear useful in obtaining data on the subculture associated with student smoking behavior.

694. Development and Description of an Assertiveness Training Program to Increase Role Confidence. Janie Spelton Weinberg, MN (University of Connecticut).

Newly graduated Registered Nurses trained in a four-year Bachelor of Science program find themselves facing a complex situation of confused roles and contradictory professional goals. Physicians attempt to push R.N.'s into a "handmaiden" role; older established R.N.'s encourage a mediating position; diploma trained (practical oriented) nurses resent the new R.N.'s background and relative lack of skill orientation. These demands are all evaluated against a school program training R.N.s to be "patient advocates", encouraging strong clinical psychological training and a systemic approach to patient problems. The result tends to be role confusion often resulting in disenchantment and a significant career turnover despite a sharp and growing shortage of nurses. The inclusion of a confidence-building and skill developing assertiveness course in the R.N. curriculum provides graduates with tools needed to personally define goals and to achieve the working atmosphere necessary to the accomplishment of those goals. The author developed and tested a role-development assertiveness training course for nursing students. Presentation includes a course outline, developmental steps, and an evaluation in terms of career longevity, job satisfaction, and immediate modification in psychological profile.

695. A Physiological and Subjective Evaluation of the Use of Neutral and Emotionally-Charged Words for Meditation. DONALD R. MORSE, JOHN S. MARTIN (Temple University School of Dentistry, Phila. Pa.).

Morse et al (Psy. Med. 39:(5), 1977, In Press) demonstrated that there were no significant differences between TM and simple word meditation (SM). TM Ss used their personal mantras while SM Ss were assigned words. To evaluate the importance of the given word, a study was initiated to compare the responses during the following conditions: alert, meditation (neutral word, "one"; emotionally-charged words, "love" and "hate"), relaxation, and silent repetition of a random series of numbers. Also studied was the effect of stress on meditation. Forty-eight Ss were monitored during these states by an examination of respiratory rate, pulse rate and skin resistance. During each alert state, Ss gave an evaluation of each experimental state. Results showed that meditation (all words) and relaxation gave significantly better relaxation responses than the alert state. There were no significant physiological differences between meditation (all words) and relaxation and between "love", "hate" and "one." Subjectively the order of preference was: "love", "one" and "hate." Physiological responses for meditation ("one") were significantly better than for "silent repetition of numbers." During meditation ("one"), stress caused a significant alerting reaction.

696. A Study of Self-Actualization. GEORGE K. CANTRELL (San Antonio College, San Antonio, Texas, 78284).

Using an inventory of self-actualization, groups of disadvantaged and non-disadvantaged students were tested. Interviews with examinees of both groups indicated that the disadvantaged students suffered, on the average, significant deficiencies in security and self-esteem when contrasted with the non-disadvantaged students. All disadvantaged students reported some self-actualizing efforts; some of them reported determined efforts. Tentative conclusions were: (1) self-actualization is a dimension, (2) self-actualization is a process rather than a condition, (3) self-actualization may occur even though subordinate needs are not met, and (4)"upward mobility" is a form of self-actualization.

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697.
Maternal Sex Role and Daughter's Career Plans.
LINDA OLSHINA LAVINE (SUNY Cortland)

Elementary school-age girls were interviewed about their career plans, perceptions of occupational stereotypy, preferred play and study modes (masculine-feminine); perceptions of desirability of masculine vs. feminine role and of parental power distribution. Parents' jobs were rated for sex-typing and social status. Maternal employment was not in itself related to perceived power of mother. However, most mothers had jobs which were secondary to husbands jobs and this is suggested as a major explanation. Maternal employment also failed to correlate with sex-type of child's career plans. However maternal power as perceived by the child is significantly related to career plans: girls with perceived powerful mothers are more likely to choose masculine careers while those with perceived powerful fathers choose feminine careers. This pattern holds true when analyzed within each socioeconomic level. Maternal employment is related to the social class of career preferred: working mothers are associated with preference for white-collar (usually feminine) jobs while non-working mothers are associated with artistic preferences. Many non-working mothers were found to be amateur artists. Such artistic preferences are likely to be less realistic guides to career possibilities than those generated by the working mother. Inferences are made regarding the role of the maternal model in career choice.

698. Automatic Mediation in Group Problem Solving. DAVID STODOLSKY (University of California, Berkeley).

Many techniques for group problem solving specify rules for allocation of turns and time limits to speakers. Most of these require a chairperson who is responsible for the proper application of these rules. An automatic mediator, by contrast, gives each person an equal degree of control over the speaker selection process and equal responsibility for invocation of the agreed upon rule. This is achieved by combining anonymous inputs using automatic rules which publicize the result. An anonymous communication channel transmits speech request signals to the mediator. The automatic mediator uses these signals to select the next speaker according to specific rules. In a telephone conferencing experiment, a computer mediator collected speech request signals and then publicly displayed the new speaker's name while simultaneously activating that person's microphone. The automated experiment incorporated a logical task for objective evaluation of different speaker selection rules. Two rules for resolving conflicting requests were compared to determine their effect on the balance of participation, individual learning, and group performance. One rule selected speakers in the order which they requested to speak; the other resolved conflicting requests in favor of the person who had thus far spoken the least. The independent channel for requests yields significant theoretical and practical advantages in the study of group problem solving.

699. Inter-Trial Handling (ITH) And Open-Field Behavior: A New Paradigm. J.W. SACKMAN, R.J. REITER (University of Texas Health Science Center at San Antonio).

The use of the open-field apparatus for the study of behavior in reaction to mild stress has been hampered by the lack of an adequate explanation of the response. A paradigm reported here appeared to define the animals' behavior to a greater extent than has hitherto been published in the literature. Two 3 min testing trials were administered to young male rats with a 30 sec period of handling inbetween the trials (ITH). In order to ensure the effects we observed were not due to retesting effects, groups of animals were also tested without an inter-trial period of handling. Groups of animals from an 8L: 16D and 16L: 8D photoperiod were tested under these conditions. Results: (1) ITH depressed ambulation during the 2nd and 3rd min of trial 2; rearing was depressed following ITH; defecation was increased following ITH; (2) 8L: 16D increased ambulation and rearing during trial 1; (3) the decrease in ambulation during trial 2 following ITH appeared to be dependent on the level of ambulation during trial 1 (i.e. the higher the initial activity, the greater the decrease during trial 2); (4) retesting effects could not totally account for the above mentioned results. Conclusions: The data obtained may be explained on the basis of a two-level fear response; the initial trial elicited a mild fear response which required the gathering of information about the novel arena. ITH elicited an increased level of fear which was characterized by very fast and erratic ambulation during trial 2, min 1 followed by a 'freesing' response with very little movement for the rest of the trial and increased defecation.

700. MCD and the Generation Gap. RICHARD MARKIN (McGrath Clinic), JOYCE A. SWEEN (DePaul University, Chicago, Ill.).

The present research involved 101 children diagnosed as having Learning Disabilities and Behavioral Disorders. These children were evaluated using a wide variety of instruments including a family background and pediatric history questionnaire and an EEG and neurological examination. Each of these evaluatory procedures was considered to represent a conceptually distinct type of information which is easily available to the clinician. First, a significant relationship was found between the children's physiological-neurological information and their questionnaire items. In addition, significant correlations were obtained between information derived from the children's parents' background and that pertaining to the children themselves. Specifically, the current research took the parent's questionnaire items (identical to the screening items used on the children) and demonstrated a relationship between historical data from the parent's childhood and certain neurological abnormalities in their offspring. The results suggest that it may be possible to predict a high risk group of children with various types of learning disorders and behavioral problems on the basis of the childhood experiences and life-events of their parents. Such information could hopefully be used in prenatal and marital counseling as well as provide some guidelines for "early warning" detection of dysfunction postnatally. The results suggest an underlying conceptual model that links both observational and neurological data to brain functioning, (i.e., surface manifestation, at various levels, of an underlying deep structure problem) not only within the individual but across generations.

701. Game Structure and Concept Discovery. ALICK ELITHORN, RICHARD COOPER (Institute of Neurology & The Royal Free Hospital, London).

Classically the problems used to study human cognition have been irregular in structure and it has in general been impossible for the experimental psychologist to manipulate systematically the variables which determine problem complexity. In addition much of the work on concept development has been related more to concept recognition than to studying the evolution of new concepts. The problem of designing novel problems suitable for studying thinking is an area of psychology which has been little explored. One type of problem which lends itself to experimental psychological studies using interactive computer techniques is the two person strategy game. A study of the natural evolution of such games has led to the identification of the parameters which determine their structure, and this in turn has led to the definition of a family of games and puzzles A is B in which the dimensionality of the problem and the levels of the dimensions can be varied systematically by the experimental psychologist. Manipulating the interaction of the variables within this calculus provides novel games for which new concepts must be evolved. The present paper describes the development of the calculus and some of the experimental applications.

702. Alpha Is Not Omega: On Inferring Scale Dimensionality from Homogeneity. ROBERT F. STRAHAN (Iowa State University).

Though the meaning of "homogeneity" has been the subject of some disagreement in the psychometrics literature, the term is generally considered to imply unidimensionality--that all items in a scale measure the same, single dimension or factor. The statistic Cronbach termed "coefficient alpha" and investigated with thoroughness is today possibly the most widely used index of a scale's homogeneity, and alpha appears to be applied routinely to demonstrate the unidimensionality of a given measure. It is in fact, however, a misleading index of unidimensionality. Alpha depends not only on the dimensionality of the scale, but also on the number of scale items and the inter-item correlations. High values of coefficient alpha can be obtained when two or even more orthogonal factors actually underlie the scale. Inferring unidimensionality when correlated rather than orthogonal factors are considered is still more hazardous. Thus alpha, reflecting, as Cronbach has shown, the total common factor variance of a scale, should not be used to determine that scale's dimensionality. Nor should such related statistics as split-half reliability coefficients, item-total scale correlations, or indices of item loadings on the first principal component. Factor analysis, not without its own problems, would appear the most feasible approach for the demonstration (or counter-demonstration) of a scale's unidimensionality.

703. A General Framework for Analyzing Information Policies. KAREN B. LEVITAN (Silver Spring, Md.).

Information is a vital national resource needing serious attention from federal policy makers and legislators. But it is generally not treated as a unique resource, separate from the subjects it characterizes, the institutions it serves or the media which convey it. The result is no policy focus on information per se, but rather, science policy for scientific information, different agency policies for management information plus uncoordinated policies for libraries, telecommunications, copyright, privacy, etc. This paper takes an holistic, systems view of information, defining it broadly as both content and media, and treats it as a unique resource worthy of policy attention in its own right. Such an approach reveals four basic kinds of federal policies that deal with information as a national resource: policies about (1) the way the government processes information; (2) the flow of information in the nation as a whole; (3) the funding of research & development on information and (4) the establishment of various information systems which support our general social, political and economic objectives at home and abroad. These four interconnected areas provide a general framework for analyzing the current status and future requirements for policies on information as a national resource. This framework is suggested as a tool to stimulate development of a national approach to information policy.

704. Optimum Machine Speech Recognition and Narrow-Band Speech Transmission Using Phoneme Codes Generated by Machine. ARNOLD LESTI (Andromeda, Inc.)

It is shown that the conversion of speech signals into a small group of phoneme codes yields the greatest reduction of complexity while retaining the essential information. This is accomplished in a working machine by decision trees using a multiple set of Super-Nodes which classify phonemes with adequate multi-speaker accuracy. The same type of processing also applies to a succession of stages converting phoneme codes to syllable, word, phrase and sentence coding, by which high order successive increases of accuracy is attained.

705. On the Nonintuitive Nature of the Correlation Coefficient: Subjective Estimation of Three-Variable Relations. ROBERT F. STRAHAN (Iowa State University).

The misleading character of the correlation coefficient was investigated in two studies of intuitive statistical behavior: estimation of partial correlation and estimation of the minimum possible correlation between two variables given their correlations with a third. Fourteen psychology department faculty and graduate students provided estimates of partial correlations, $r_{xy \cdot z}$, for varying positive values of r_{xy} and $r_{xz} = r_{yz}$. Mean estimated $r_{xy \cdot z}$ values were uniformly and for the most part substantially lower than theoretical (actual) values. Twenty-four statistics students and 16 statistics department faculty and graduate students furnished estimates of minimum possible correlations, min r_{xy}, for varying positive values of $r_{xz} = r_{yz}$. For both samples mean estimated min r_{xy} was substantially higher than the theoretical (actual) min r_{xy}. Thus, in both studies, subjects overestimated the degree of influence on the correlation between two variables, X and Y, of a third, constraining variable, Z. The hazards of intuitive, order-of-magnitude inference in the interpretation of correlational data are apparent.

706. The Statistical Analysis of Mutually Interfering Experiments. RON WRIGHT (University of Massachusetts).

In the last three-quarters of a century, particularly through the development of quantum mechanics, it has become clear that certain measurements, that is, certain experiments, made on the same system, interfere with one another. This is true not only in physics, but in diverse areas such as opinion polling and psychological testing. Since it is not possible to perform two such "complementary" experiments simultaneously, these interference effects cannot be described by conventional statistics in which all possible experiments are (measurable) partitions of a single sample space. In Amherst, we have developed a mathematical apparatus which can simultaneously describe a coherently related collection of experiments, including, but not limited to, those occurring in nonrelativistic quantum mechanics. Many of the traditional statistical techniques can be generalized to this setting, such as maximum likelihood estimation and Bayesian analysis.

707. Randomly Connected Neural Nets. PAUL CULL (Oregon State University).

McCulloch-Pitts nets have long been used as models in psychology, neurophysiology, and even genetics. These models have generally been quite small since in spite of the simplicity of the individual formal neurons large nets are generally quite complex. We study large nets by assuming that there is a constraint on the number of neurons that have a direct connection to any given neuron but that within this constraint every neuron is equally likely to synapse on a given neuron and by assuming that the output of the neuron as a function of its inputs is a randomly assigned but then fixed function. Even though this in general is a nonlinear system we show that it can be linearized by considering it as a system over a larger space. This allows us to calculate the expected cyclic behavior of a net under various constraints. We are able to calculate the expected number of states in cycles of various lengths, to calculate the expected cycle length, and the expected number of cycles. The formal analog of the Fast Fourier Transform allows us to quickly calculate the behavior of the net from its functional specification and to construct a net with a desired behavior.

708. Prenatal Amphetamine, Maternal - Offspring Interactions and Preweaning Behavior in Rats. HARVEY [illegible] (SUNY - Binghamton) PETER J. DONOVICK (SUNY - Binghamton) RICHARD G. BURRIGHT (SUNY-Binghamton).

Female rats were given either 5mg/kg, 2mg/kg, or 0mg/kg d-amphetamine sulfate, mixed with their drinking water, from 30 days prior to mating until parturition. Maternal-offspring interactions were examined with time lapse photography. Righting latencies at 1,3,and 6 days postpartum, open field activity and bridge crossing behavior at 7,14 and 21 days of age were measured for the pups. Drugged mothers spent more time with their litters in the nest during the first 3 days after birth. No other differences were noted in these interactions or in contact of mothers and litters from days 3 to 21. Turnover latencies were longer for the offspring of drugged mothers. In addition, these pups showed more square crossings in an open field at 7 and 14 days of age with the differences disappearing at 21 days of age. The groups did not differ in falls from the bridge, slips, or time to cross in the bridge crossing task.

709. The Origin and Function of Emotions. DONALD V. HIRST, MD University of Nebraska Medical center.

Since certain emotions may produce disease and death, the correct understanding of emotions is essential to medical diagnosis and treatment. Traditionally, emotions have been assumed to be psychogenic. In the last 25 years research has shown centers for emotion in the limbic brain that are directly tied into the hypothalamic and autonomic centers of body control. Whenever an emotional center is stimulated, there is specific conscious emotion with a related body response however large or small. There are centers for pleasurable or positive emotions with positive body responses and other centers for painful or negative emotions with negative body responses. Positive stimulation produces the normal steady state which is the correct physical and emotional state for daily living. Negative stimulation produces all shades of emotional pain and with strong stimulation the alarm state which is either fear with an overwhelming compulsion to run or rage with an overwhelming compulsion to fight--fuges and unprovoked aggression. Acute alarm in the face of danger is appropriate but chronic alarm in the absence of danger produces disease and death. Chronic alarm has a very definite differential diagnosis and treatment.

710. Differences in the Perceptions of Stress by Male and Female Psychiatric Patients. MAXINE L. WEINMAN (Texas Research Institute), GEORGE MCBEE (Texas Research Institute)

Sex differences in the perception of illness and subsequent illness behavior patterns has been the focus of recent interest. This study deals with sex differences in the perception of stressful life events prior to onset of psychiatric hospitillization among a group of fifty patients. Information was collected by interview on this group of patients following admission to the unit. A battery of psychological and social instrumentation was given to collect morbidity information. In addition, the Recent Life Change Events Questionnaire* was given to collect information of recent stressful life changes. Discriminate function analysis was used to test for the significance of sex differences in areas of personality characteristics, social role adjustment, symptomatology, and stressful life events. These differences provide useful information for the management of the patient in the hospital and for therapeutic recommendations at discharge.

*B. JUSTICE, G. MCBEE, and R. ALLEN, Life Events, Psychological Distress and Social Functioning. Psychological Reports, 1977, 40, 467-473.

711. Information Processing Error in the Affective and Organic Dysfunctions of Later Life. NANCY E. MILLER (National Institute of Mental Health).

Anecdotal accounts suggest that primary memory remains intact both in advancing age and in conditions of altered brain function. To examine this hypothesis, a choice-R.T. memory scanning task was administered to 108 persons 50 years of age and up referred for psychiatric evaluation. In this procedure, digit strings ranging in length from 1 to 6 digits were displayed in a horizontal linear array for 3 seconds, followed by a 2-second delay. A single digit was then presented and the S was to decide whether the digit had appeared in the preceding sequence. Each S was evaluated for presence of brain dysfunction and for depression. Regardless of diagnostic classification, all Ss manifested a monotonic decline in accuracy as task difficulty increased. While those with brain dysfunction showed the steepest deterioration in performance with increasing digit set size, depressives also manifested significant impairment in accuracy of information retrieval. Correlations between accuracy of response and number of years of education were substantial and highly significant. These findings suggest that traditional assumptions regarding the imperviousness of primary memory to pathology-linked decline in the aged are not substantiated, and that accuracy of response in memory scanning is strongly related to behavioral measures of cortical intactness and amount of formal education.

712. Multivariate Analyses of the MMPI Profiles of Pain Patients. CHARLES K. PROKOP (Highland Hospital, Division of Duke University Medical Center), LAURENCE A. BRADLEY (Fordham University), ROBERT D. MARGOLIS (Clayton Mental Health Center, Riverdale, Georgia).

Minnesota Multiphasic Personality Inventory (MMPI) profiles of patients with low back pain (LBP) and pain with other foci were evaluated by a multivariate clustering technique.

The patients had been referred for psychological evaluation over a three year period. Replicable subgroup profiles found to be significantly different from one another through a multiple discriminant function analysis were derived. Among the LBP patients, male patients showed three replicable personality types while female patients showed the same three profiles as the males with the addition of a "conversion V" profile subgroup. The multiple pain patients' profiles were more heterogeneous. The same three profile types were found in the male multiple pain patients as in the male LBP patients, with the addition of a profile suggesting a depressive reaction. The female multiple pain patients presented three of the four profile types found among the female LBP patients, with the most disturbed MMPI profile subgroup absent. The research suggests that chronic pain patients are not characterised solely by conversion personality dynamics, but that the personalities of pain patients vary with sex and are also related to the type of pain involved. Treatment selection may thus be influenced by personality differences.

713. Psychosomatic Disease: Empirical Support for Autonomic Learning in the Development of Specified Disease Syndromes. THOMAS F. BRENNAN (Chestnut Hill College).
A new revision of autonomic learning theory proposes that the perception of stimuli as stressor agents arouses the body to deal with the perceived stress. The arousal system utilizes both the nervous system and the endocrine system according to a pattern developed as a result of both escape and avoidance conditioning. The pattern of behavior and consequent disease can be expressed in one of three modes; a flight syndrome, a fight syndrome, and a social or sexual syndrome. The three basic patterns are hypothesized on the' basis of the appropriate hormone/neurotransmitter substance utilized rather than on overt behavior patterns. Reaction to the stimulus is internalized, thus producing the disease and reducing the arosal level, rather than externalized in a socially acceptable manner which, although also reducing the arousal level, would not give rise to the disease. The arousal of the sympathetic nervous system depletes bodily resources and cells of the target organ become susceptible to invasion by microorganisms, viruses, and chemical agents A fifty-five item questionnaire was developed to measure three hypothesized personality attributes of fear, anger, and sociability. An attempt was made to phrase the items in such a way as to make the subjects unaware of the nature of the attributes under assessment. The three scales were then analyzed and correlated with responses from another questionnaire assessing symptoms of eight disease syndromes

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714-738 ECONOMICS, EDUCATION, & POLICY POSTER WED., 15 FEB., 3 P.M./ SP EXHIBIT HALL

714. Vehicle Routing and Scheduling: Theory and Practice. BRUCE GOLDEN and LAWRENCE BODIN (University of Maryland at College Park).

Vehicle Routing and Scheduling problems are almost always encountered by complex organizations and reliable and efficient algorithms for dealing with them are needed. Recently, higher vehicle costs due to increased oil prices and rising truck drivers' salaries have motivated operations researchers and industrial engineers to study these issues more carefully. The vehicle routing problem is to obtain a set of delivery routes from a central depot (or several depots) to the various demand points each of which has known requirements, which minimizes the total distance covered by the entire fleet. Vehicles have capacities and maximum route time constraints as well as other characteristics; demand points may have pre-specified due-dates. With this in mind, the scheduling component must assign trips to vehicles in a most economical way. In this paper, we provide an overview of vehicle routing and scheduling.

715. Impact of Satellite Technology on Decisionmaking in Business and Government. ARTHUR L. LEVINE (Department of Public Administration, Baruch College, City University of New York).

Recent advances in the technology of earth resources, communications, navigation and weather satellites provide new sources of input into the decisionmaking processes of business and government. Networks of earth-oriented satellites in combination with super-speed computer systems will provide continuous monitoring of significant physical, economic and habitation activities, facilitating change detection and flagging impending opportunities and dangers. In the private sector, this technology will impact decisions on mining and oil exploration, plant location, farming, construction, and national and international market strategies. In the public sector, impact will be on national and international decisions on agricultural policies (famine prevention), land use planning and management, including water resources and coastal zones, environmental protection, natural resources management and regional/urban planning. Social, economic and political implications of these developments are assessed, with particular reference to impact on world standard of living and quality of life.

716. Full Employment Maintenance in the Private Sector by Directed Adjustment of Job Vacancy Projections. GIFFORD A. YOUNG (National Aeronautics and Space Administration (rtd.), Washington, DC 20546).

Behavior of interacting business firms is explained in game theory by a "prisoner's dilemma" matrix in which the payoff consists of the benefits to be gained by hiring or not hiring the last increment of the unemployed. The players are forced interactively into decisions to accept less than full production, employment (hence demand), and profits. Government provision of public service jobs, extension of unemployment benefits, and grants of employment tax credits are misguided and ineffective because they do not impact the firms' actual employment decision process. To assure invariant full employment and output, government intervention (in an otherwise free enterprise economy) should provide for (1) a legislatively prescribed maximum permissible unemployment rate (e.g., 3 percent); (2) periodic (e.g., quarterly) submission by each private sector entity of its net numerical hiring or firing projections (built upon existing experience with the Bureau of Labor Statistics job vacancy statistical programs); (3) feedback of a uniform percentage change by which each firm must accelerate or slow its planned net hiring or dismissals so that aggregate unemployment during the period will not exceed the permitted rate. Feasibility lies in the firms sharing in a higher level of overall economic activity, more effective fiscal and monetary policies, and the repetitive opportunities for each firm to revise its planning.

717.
Work-sampling as a Tool for Analyzing Social Programs. ALEC I. McKAY (Petroglyph Research Associates, Olympia, Washington)

Work sampling can be a useful tool for program evaluation and planning. A summary of several alternative techniques is presented. A random moment sample adapted to telephone implementation is presented in detail, including the mechanics of conducting the sample, the variety of useful information which can be obtained by the techniques, and some positive and negative features of the system. Results of a one-year sample on seven local social service offices in the state of Washington will be utilized for illustrations.

718.
Cost Effectiveness of Inservice Training in Long-Term Care Administration. PAULINE KOUF, MARGARET McFARLANE (State of Washington), EUNICE BAXTER, ALEC McKAY (Petroglyph Research Associates).

Project goals are: 1) evaluate cost-effectiveness of state sponsored inservice training programs in long-term care administration; 2) develop a quality of care measure for long-term care; and 3) determine if program evaluation can be realistically done within a state agency. Program effectiveness is based on a client-centered measure of quality of patient care. The instrument relied on previously developed and tested items, largely from the P.E.S. developed by Medicus Systems Corp. Items were categorized into profiles; cluster analysis used to delete inappropriate items; and regression analysis utilized to detect changes resulting from the intervention. Data collection utilized a time-series design. Eighteen homes were involved and approximately 300 long-term care residents interviewed in each of three visits. Results indicate several aspects of "quality of care" can be measured reliably. The effect of training programs was not significant in most cases. A broader conclusion is that problems with intra-office priorities, personnel, and budgets made program evaluation very difficult in a state setting.

719. Public Health Costs of Air Pollution: A Phenomenological Approach. K. Campbell, H. W. Lorber (Los Alamos Scientific Laboratory).

A new method is proposed for estimating the costs of deterioration of public health due to air pollution. The method focuses on the phenomenological aspects of ill health, such as the number of days lost from work, rather than its etiology. As a result, the method avoids relying on poorly known correlations between specific diseases and air-pollution levels, and it expresses health costs directly in terms comparable to the costs of pollution abatements. Theoretically the method is based on the fraction of time a person spends per year at each point on a continuum extending from perfect health to imminent death, and the costs incurred per day depending on a person's position on the continuum. Costs due to ill health are classified as direct costs for health care and indirect costs resulting from losses of productivity. We refrain from putting a dollar value on pain and suffering from ill health other than through the direct health-care costs. Empirically, the method makes use of a nonlinear regression, due to Thomas, relating age- and sex-specific mortality rates to disease-nonspecific morbidity data for restricted activity, confinement to bed, and hospitalization. Moreover, following Lundy and Grahn, the method links mortality rates to pollution levels through a model generalized from data on the mortality of cigarette smokers. Being essentially a perturbation technique, the method is applicable to polluted as well as pristine localities.

720. Imperative Capital. R. J. BECKER (Arizona State University)

The imperative nature of capital is implicit in the extensive literature on capital. Writers from Hammurabi and Aristotle to Smith, Marx, and Carlyle, and present professionals have indicated this imperative nature. It is a significant matter.

Capital is a factor of production which, when used, yields income to its owner: hopefully not less than the going rate of interest. A contracted employee, too, is an investment, and has the nature of capital. If the capital is not used, (1) the owner loses the potential income, and (2) loses the opportunity to earn interest on the money value of the capital. The expectation to earn income by the employment of the item (investment) is a necessary part of the classification as capital. The two features, opportunity cost of loss of interest, and, beyond that, of higher potential earnings, impose the necessity for continual use of capital, on its owner.

An owner may be an individual, a business company, a city, or other government agency.

Part of the drive for growth originates in the capital imperative. Capital is the research and development apparatus, the human capital, and the construction-manufacturing machinery that becomes "idle" when "growth" is not sustained.

RANN may be seen as a manifestation of the capital imperative. "The National Science Foundation supports a program...to assess needs and opportunities for more effective application of science and technology."

721. A Sensitivity Analysis of the Cost Effectiveness of Five Alternative Sources of Electricity for Hobbs, New Mexico. James F. Horrell, David A. Huettner, Benjamin J. Taylor, (The University of Oklahoma).

Based on engineering baseline cost information, 32 alternative electrical generating options for Hobbs, New Mexico were determined. The 32 alternatives can be partitioned into five basic sources of energy: (1) solar (2) imported oil (3) gasified coal (4) low sulfur coal and (5) nuclear. The solar and nuclear sources are further partitioned to yield twenty-one solar options and eight nuclear options. The solar options are central receiver, cylindrical trough, parabolic dish non Brayton, parabolic dish Brayton system A, fixed mirror distributive focus, and dispersed photovoltaic. The eight nuclear options are generated by considering two levels of load factor, two levels of burn rate and two types of Plutonium recycle credit. In the delineation of the baseline costs for each of the options, there are a number of salient cost parameters that could potentially vary. Reasonable intervals of variation have been selected for these variables and the present value of a thirty year cost sequence has been calculated for a matrix of parameter value combinations. The sensitivity analysis yields two 32 x 36 matrices. By a careful assessment of the patterns of a series of partitioned submatricer the effects of variations in salient cost parameters on the desirability and viability of a particular option/sub option is ascertained. The details of the techniques and the results are given.

722. Using Financial Incentives to Promote Solar Energy. DOUGLAS L. MAXWELL (General Electric-TEMPO, 777 14th Street, NW, Washington, DC 20005)

The use of financial incentives for the promotion of a new technology raises several difficulties of a practical and normative nature. Public subsidies are more likely to improve economic welfare if some of the benefits of research escape the researcher or if the end product has positive externalities. There are more difficulties if the product will replace a substitute product with negative externalities, if subsidies are necessary to drop down a learning curve to a commercial price, or if the success of the product is too uncertain to attract private support. These problems are discussed at a theoretical level and then illustrated with the example of ocean thermal energy conversion.

723. Energy Analysis and Environmental Benefit/Cost Analysis. MITCHELL J. LAVINE (Cornell University), ARNIM H. MEYBURG (Cornell University).

Energy analysis, instead of traditional benefit/cost analysis, is used to evaluate and compare proposed alternatives for a highway project in Florida. In order to include both economic and environmental factors in the same evaluations, energy is used as a common metric. Energy flows associated with both economic activities and natural-systems activities are evaluated and combined. The energy flows of natural systems provide free services which complement the services which are paid for in economic systems. Maximizing the combined natural- and economic-systems services in the region is the basic analysis criterion. Consequently, the choice of alternative projects is determined according to which project will result in the greater increase of the region's energy flow. Evaluations of this case study reveal the region's increase of energy flow associated with each alternative. They also reveal that further preservation of natural systems may result in a net increase of energy flow, thereby increasing services in the region.

724. Nuclear Power Engineering Requires Greater Integration of Values Derived from Liberal Education.

SIGURD O. NIELSEN (Symplexor Engineering Consultants Inc, Holte, 2840 Denmark)

Nuclear power is a viable option for the future in many countries, although it harbors maybe the major social confrontation of our time. The resolution by the public of the major questions that are inherent in the use of nuclear technology requires that they are illuminated in a broad context that also includes societal and ethical concerns. Engineering design of a nuclear power system, component, or process to meet desired needs must not only follow sound engineering practice, but must also select those designs that meet the public's societal and ethical concerns. The engineer working with nuclear power should note, however, that the popular protest against nuclear power is in many countries to a large extent a symbolic protest, its hidden target being some of the prevailing conditions and developments in modern Western societies. He should, therefore, welcome a broad public discussion of the future role of nuclear power in order to demasquer the popular protest, so that he can learn which design criteria he should concentrate on, so that his design eventually might obtain firm public backing. Here we look, as an example, for such an optimum strategy to follow in order to close as soon as possible the back end of the light-water-reactor fuel cycle in a manner that attempts to meet the public's main objections. These include: risks of proliferation and of theft of plutonium; the assessment of the risks from geologic disposal of high-level waste or spent fuel elements is in part subjective. An international solution is given.

725. Shelby Farms: A Potential National Research Center Demonstrating Alternative Appropriate Technologies Combining Ecological Agriculture, Urban Waste Utilization and Environmental Management Methods.

PHILIP J. MUMMERT (Memphis State University).

Shelby Farms is a publicly-owned 4,500 acre site consisting of farmland, forested floodplain, upland lakes and bordered by a river situated within the metropolitan area of Memphis, Shelby County, Tennessee. Its preserved state, variety of natural features, unique location, special environmental character and current plans for the area combine to highlight its potential as an outdoor research, demonstration and educational laboratory with emphasis upon new ways to conserve energy in food production, sustain ecologically-sensitive agricultural management, reuse and recycle urban wastes, manage natural resources and protect the environment. Of special interest are programs that can demonstrate unique combinations of appropriate technologies on a small scale. AAAS Annual Meeting attendees are invited to learn more about Shelby Farms, contribute ideas, explore possibilities, identify research priorities and participate in the planning of this special urban resource.

726. The Promise of Science and Technology.

JOHN F. KINCAID (The Johns Hopkins University)
JUNE GABLE (Department of the Navy)

The history of technology records two quantum jumps in the rate of introduction of technological innovations. These are attributed to the written language based on the alphabet and to the efficient power operated printing press. All the necessary elements for a third technological revolution are at hand: the need posed by the great problems of this era; the computer, a revolutionary tool for the efficient utilization of knowledge; a huge supply of accumulated knowledge; and the availability of a large pool of scientists and engineers.

In a favorable climate, the tools of technology can play a dominant role in many global problem areas: social, political, economic and technological. Only a well-informed public can create this favorable climate and ensure the application of technology for solutions to problems of human welfare.

727. A Value Heuristic For Solving National Problems: A Transdisciplinary Approach to Public Policy Formulation.

F. JAMES CLATWORTHY (Oakland University, Rochester, Mich.)

The problem with our current approach to solving national problems is not a lack of specialist knowledge, but a lack of utilizing a comprehensive anticipatory design science. Perhaps the development of human synecology as a transdisciplinary science dealing with the interactions of individuals within communities and the environment including other communities could scientifically verify the formulation of a policy guide such as humanistic community development. The utilization of a value heuristic for guiding policy could result in a coordinated problem solving approach and a maximization of tax dollars spent for achieving national goals.

728. Networks of Amateurs for Scientific Research and Monitoring.

JOHN R. WHITMAN (Education Development Center, Inc.).

Scientists in the United States and some other countries have successfully organized large-scale networks of amateurs to collect observational data and samples for scientific research and monitoring efforts.

The technique of involving networks of volunteers for research has potentially useful application in a wide variety of fields. Historic examples include weather monitoring and satellite tracking. Current examples include earthquake monitoring, variable star observation, and botanical data and sample collection.

The author recounts several successful volunteer network experiences; discusses some positive and negative features of network design, development, and management; and calls for greater utilization of the network approach by scientists as a strategy to: (a) facilitate certain research efforts in an inexpensive way; and (b) increase public understanding of science through direct involvement.

The author also describes a newly developing effort to help scientists establish networks of volunteer assistants in a way that responds to their research needs on the one hand, and to the educational interests of the amateur participant, on the other hand.

729.

International Programs on Science, Technology, and Human Values.

CARINA CHRISTIAN (*President, UNESCO Association of Hawaii; AAAS Representative Hawaii*)

International scientific symposia and community forums have been held in 1977 and are being organized for 1978-79 on a broad range of topics such as *Quality of Life in Year 2000 and Beyond; Genetics and Human Values; Alternative Sources of Energy; Science and Art;* etc. Several conference sites have been proposed for 1978-79 which include *Hampshire College, Mass.; Wingspread Conference Center, Wisc.; College of San Mateo, Calif.; Chaminade University, Hawaii; Simon Fraser University, B.C.; University of Paris, France; University of Geneva, Switzerland.* Speakers have been nominated which include distinguished scientists and humanists from the U.S.A., Canada, France, Great Britain.

All interested in proposing conference sites and nominating speakers, may do so at the AAAS Annual Meeting in Washington.

730.

Thoughts on Intellectual Claustrophobia (Innovative Approaches to Interdisciplinary Programs in Higher Education).

CARINA CHRISTIAN (*Director of Institutional Research, Chaminade University; Acting Head, Science Department, Hawaii Pacific College; University Without Walls*)

The development of interdisciplinary academic programs is increasing exponentially in the United States and in foreign countries.

A variety of nontraditional teaching strategies will be presented which have been introduced by the author in interdisciplinary courses that she has developed at the *University of California, Berkeley; College of San Mateo; University of Hawaii; Hawaii Pacific College.* Topics include: *Search for Extraterrestrial Intelligence; Science and Human Values: the Ascent of Man; Physics and the Environment; Man's Place in the Universe: Between Quarks and Quasars;* etc.

In addition, innovative programs from other universities and colleges will be presented. These are part of a study of over fifty centers of higher education in the United States, Canada, and Europe, which will be published as a book titled *Thoughts on Intellectual Claustrophobia, by Carina Christian.*

731. A Proposal to Institute University On Demand Publising Instead of Publishing Esoteric Journals and Monographs. Joseph Agassi, Boston University and Tel-Aviv University.

The role of learned journals is to communicate yet publication forces people to publish for a different purpose. This purpose can be met without the pretense by having quality publishing houses approve of works for publication without printing hundreds of unread copies. Instead of having University Publishing Houses that are vanity presses which at times use open market clearing houses, we can have university clearing houses that use open market publishing houses. The clearing houses can also serve university libraries by means of telecommunication rather than by cluttering their spaces with unwanted materials. Supply must be better tailored to demand in the vast market of exploding information and all extraneous motivation to flood the market with undemanded information should be studied and rechannelled to different routines. Also, tenure committees may try to differentiate between different publications and their exact meaning as meters of the candidate's worth to his university.

Such exercises are called for and professionals are wary of them since they are interdisciplinary, involving the philosophy and the sociology of science, economics, sociology, and the institutional reform of the Commonwealth of Learning.

732. Strategy for the Future: The Scientific Approach to the Future. W. C. MOORE J. D. (The World Future Society)

The scientific approach to the future is Humane, Systemic, Holistic, Inter-disciplinary, Rigorous, Dynamic, Continuous, Synergistic, Responsible, Ethical. A Paradigm of the Entirety. A World Institute for Systems Education (W I S E) is proposed, composed of already existing centers in a global tele-communications data processing network. It will concentrate on global systems of immediate practical use to the "real World" of industry, business and government. Each center is connected with a university or a consortium of universities, permitting an exchange of teachers, students, textbooks, audio visual aids. The network will constitute a global man-machine system. If you like, a World Brain; essential to forging the Future.

733.

"Universitas" - An Institute for the Higher Intellectual, Aestheric, and Moral Culture. YANOOSH OSTROWSKI.

The purpose of the Universitas is to give a modern man, particularly a young professional, a general knowledge, deeper understanding, and a guide concerning the world, civilization, and man. It enables him/her to cope more properly with problems of our rapidly changing lives. All present ways of supplying general knowledge are inadequate because of their fragmentary character which often causes a chaos in people's minds. In the Institute each subject forms an inherent part of the whole curriculum and loses its sense if it is taken separately.

It seems that all the strategies for solutions to the multicrises besetting our civilization may be less effective, if not powerless, when applied to a culturally unprepared population. If mankind is to use Science & Technology not against itself, to keep alive the best cultural achievements of the past, and to create new works and values, the larger part of the population has to understand and experience our civilization.
A needed higher form of democracy needs a higher form of public consciousness. A needed worldwide cooperation cannot be based upon tottering legs of political pacts; it needs a mutual understanding among nations and cultures. The goal is to show and convince people that mankind has a common destiny living in the only home - Earth - and that all the people have much more to do together than fight each other: to contend with destructive forces - from outsude and from human nature - as well as to create and experience a really great civilization.

The four major parts of the Universitas: Nature of Man - the Creator & Product of Culture, Activities & Works of Man - Elements & Factors of Civilizations, Evolution of Human Societies - Historical Pattern of Civilizations, and the Great Problems of Our Time - Rational Approach to Their Origin, State, and Solutions; the 24 minor parts; and methods of instruction are designed to raise people to a higher level of cultural life and understanding of our time, which seems to be helpful in cooperation, survival, and creation of the future of humans.

734. Designing Educational Futures: Applications of Comparative Futurology to Education. F.JAMES CLATWORTHY (Onkland University,Rochester, Mich.)

The teacher as an anticipatory design scientist is developed through their involvement in a seminar/workshop that focuses on the analysis of problems through a comparative futures perspective. The use of comparative futures gives teachers an opportunity to explore possible futures and gain first hand experience with designing futures and formulating policy for bringing a future into reality. The methodology of comparative futurology applied to education offers teachers, and thereby students, an opportunity to experience anticipatory design science, and apply it to problems or issues that affect their lives. Applications for secondary school curriculum should be considered as an alternative for integrating basics into a general problem solving course with community development objectives.

735. No Pinnacle Has Been Reached. M. M. CHAMBERS (Illinois State University, Normal, IL 61761)

Hypothesis: Expansion of doctoral and postdoctoral studies in all academic and professional fields is the key to improvement of schooling at all levels from infancy onward, and to the advancement of humane civilization. The paramount factor in improving schools is the provision of many more teachers, educated beyond the stages hitherto acceptable. The earned doctoral degree is not the ultimate union card for university or college professors. It will be supplanted, gradually over a generation, by a record of substantial postdoctoral studies, continuous or recurrent. Greatly increased numbers of doctoral degree-holders (both of the conventional research-oriented types and from newer more flexible and interdisciplinary programs) will infiltrate the faculties of community colleges and all lower schools. In a sense the opportunity is greatest at the level of preschools and day-care centers, where crucial advances can be made in education, nutrition, good health practices, and general physical and mental development. Thus expansion and betterment of doctoral and postdoctoral studies is the leaven for the advancement of all education. There will be a growing stratum of postdoctors having some of the qualities of generalists able to counteract the excessive fragmentation of knowledge in university instruction. Benefits will also accrue to governments at all levels and to the whole of society from a better-educated citizenry, and from a large and growing pool of expertise to seek solutions of complex economic and social problems.

736. CONDUIT an Experiment in Transfering Computer-Based Materials. JAMES W. JOHNSON (CONDUIT, The University of Iowa), HAROLD J. PETERS (CONDUIT, The University of Iowa).
CONDUIT is a consortium of major universities, supported by the National science Foundation, whose purpose is to facilitate use of instructional computing at the collegiate level. CONDUIT seeks to accomplish this purpose by providing instructors with ideas, curriculum materials, and information about instructional computing; and by encouraging instructors or development teams to produce learning materials that are useful to educators at other schools. This session (via graphic materials and a self-contained slide exhibit) will describe CONDUIT and its activities and present its major finding's on how to facilitate the transfer of innovative science education. Major themes are: evaluation and review, creating a transferable package, and overcoming technical problems.

737. The Need for Scientifically and Technically Literate Legal Generalists.

Thomas G. Field, Jr. (Franklin Pierce Law Center)

A description of the need for lawyers prepared to be able effectively and responsibly to cooperate in the social application of highly technical subject matter. There will be a brief discussion of the scope, volume and quality of current interactions between scientists and lawyers, but the focus will be on an evolving approach to preparing lawyers for such a role as a part of their formal, legal education.

738. Teaching About Population. Elaine M. Murphy (Zero Population Growth, Inc.). Marjorie B. Dahlin (Zero Population Growth, Inc.).

Population change--because of its implications for the individual, society and the ecosystem--has recently become a topic of increasing interest to educators and curriculum specialists. The AAAS, the National Academy of Sciences, the United Nations World Population Conference and a Presidential Commission, among others, have expressed support for population education from kindergarten through college and beyond. However, recognition of the importance of population education must be translated into lesson plans, written and audio-visual materials and teacher-training. This poster session will present the nationwide teacher-training work of the ZPG Population Education Project, funded by the U.S. Office of Environmental Education and private foundations. The teacher-training workshop model, the population education teacher's kit, the population education leader's guide, population materials from many organizations and data on workshop participants' written and graphic form and through interaction with ZPG project directors.

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